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The Moral Foundations Conflict Task: Measuring intuitive conflict between moral foundations using a novel task

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Lay Summary

People have been pondering moral questions for centuries. But what makes some things more morally right or wrong than others? And why do some people answer this question in very different ways? Moral Foundations Theory seeks to answer this question, proposing that our moral judgments are driven by several moral intuitions, or 'foundations', that have been shaped by our evolutionary history, but that are also shaped by our social and cultural learning. But if this is the case, and we have multiple moral intuitions that guide our judgments, these intuitions might sometimes clash with one another in ways that are quick and automatic, before we have had a chance to reflect on them. In this research, we set out to capture such clashes, or conflicts, between these intuitions. To do this, we have developed a new task – the Moral Foundations Conflict Task – that asks people to quickly make choices between foundations, judging which is better (for virtues) or worse (for vices), e.g. is it better to 'act for the good of the group' or to 'treat everyone equally'. We argue that what people choose, and how long it takes them to choose it, may tell us something important about moral intuitions. Across five studies we compare this task against an established questionnaire measure of how much people value different foundations. In our first three studies, we find that the relationship between these two measures is a close but not perfect match, and does not change even when people are not able to pay much attention, indicating that we really are measuring intuitive choices with this task. Across a further study we find that this match does not seem to change when people are asked to pay close attention, but we are not able to draw many conclusions about this. In our fifth and final study, we show that the task captures unique aspects of other important variables that are relevant to moral values, such as people's political ideology and attitudes towards society, that are not captured by the established questionnaire measure of moral foundations. Across all these studies we find that the task is a stable and reliable measure of preferences for foundations and that patterns in response times support our interpretation that it is tracking intuitive conflict between moral foundations. Thus, in this research we demonstrate that looking at how people intuitively trade-off moral values against one another is a valuable approach, and, based on our evidence, we have developed a tool that seems to do this well. We hope that this contribution will help further test and develop theories of morality.

Abstract

This thesis represents a body of work to validate the Moral Foundations Conflict Task (MFCT), a novel measure that aims to probe directly at intuitive conflict between moral foundations. Moral Foundations Theory (MFT) explains variation in moral judgments on the basis of innate and intuitive foundations, representing distinct moral concerns. However, little work has explored how foundations might compete within individuals. Prior research has tended to rely on an explicit self-report measure – the Moral Foundations Questionnaire (MFQ). In contrast, the MFCT requires quick, intuitive choices between foundations, tracking endorsement based on how often they are chosen, and how long it takes to choose them (response times – RTs).

Across five studies, we test whether responses on the MFCT: reflect explicitly-endorsed moral values measured by the MFQ (Study 1); are altered under cognitive load (Study 2 and 3); and under deliberation (Study 4); and are predicted by established correlates of the MFQ (Study 5). Endorsements on the MFCT reliably correlate with those on the MFQ. Increased load does not affect this correlation, enhancing confidence that the MFCT is an effective measure of moral intuitions. Increasing deliberation over choices in the MFCT also does not seem to alter this correlation, though this finding is subject to limitations to Study 4. Furthermore, the MFCT performs better than the MFQ in models with political orientation, authoritarianism and social dominance, indicating that the MFCT captures unique variance that the MFQ does not. Across all studies, we employ exploratory analyses of RTs, applying Ex-Gaussian decomposition alongside analyses of mean RT to support interpretation of the MFCT as a direct measure of inter-foundation conflict. An Ex-Gaussian approach models RTs as a combination of pure decision processes and conflict resolution, where the τ parameter corresponds to the latter. Generally, we find that mean RT and τ decrease as the value, and the difference in value, of foundations in a choice increases.

In conclusion, this work provides a significant theoretical and methodological contribution, allowing future research to explore inter-foundation conflict. It demonstrates that the MFCT captures systematic variance in foundation endorsement, and can therefore contribute to understanding of moral value conflicts and their consequences.

1 Chapter 1: Prologue

1.1 Context of this research

What is worse: turning away vulnerable refugees from war-torn countries in need of safety and protection, or overloading social services, housing departments, health systems and schools, and taking support away from fellow citizens? Moral conflicts like this pervade not only debates on asylum-seekers and immigration, but numerous other issues that split the political domain – including climate change, the rights of sexual minorities, and gun control. How are judgments made about these moral conflicts?

Moral Foundations Theory (MFT) presents a social psychological framework for examining the mechanisms that lead to divergent moral beliefs and values. MFT explains moral divergence as varying manifestations of five innate, intuitive foundations that drive moral judgments (Haidt & Joseph, 2007), a claim which has been recently challenged in terms of the structure and nature of foundations (Jacobsin, 2008; Jost, 2012; Kugler, Jost, & Noorbaloochi, 2014; Schein & Gray, 2015, 2018). MFT has had empirical successes in accounting for moral disagreement across individuals, particularly in political contexts (Graham, Haidt, & Nosek, 2009; Haidt & Graham, 2007; Koleva, Graham, Iyer, Ditto, & Haidt, 2012). Empirical findings with left-right political orientation remain the most well-known and widely replicated (Graham et al., 2013): liberals endorse the individualising moral foundations of care and fairness, more strongly than the binding foundations of authority, loyalty, and purity, while conservatives, on the other hand, value foundations relatively equally (Franks & Scherr, 2015; Graham, Haidt, & Nosek, 2009; Graham, Nosek, & Haidt, 2012; Graham et al., 2011; Milesi, 2016, 2017; Nilsson & Erlandsson, 2015; Van Leeuwen & Park, 2009).

However, one under-addressed issue is inconsistency in moral judgment within individuals. If moral judgment is driven by innate, intuitive foundations, conflict should both be apparent at an intuitive-level and should be related to deliberated endorsements of foundations. In other words, while situational factors may differentially trigger moral foundations and thus potentially lead to notably different judgments to seemingly similar problems, even within individuals (Greene, Nystrom, Engell, Darley, & Cohen, 2004; Greene, Sommerville, Nystrom, Darley, & Cohen, 2001; Moore, Clark, & Kane, 2008), relatively little is understood about how people process and resolve intuitive moral conflicts. This is an importantly distinct question than that which has been addressed in a wide variety of work on dual-process models of moral judgment (Crockett, 2013; Cushman, 2013; Cushman & Greene, 2012; Greene et al., 2004; Haidt, 2001; Moore et al., 2008; Moore, Lee, Clark, & Conway, 2011). The current, unaddressed, question is how conflict between automatic, intuitive level moral values is processed and possibly resolved *at the intuitive level*, prior to recruitment of controlled or model-based (Crockett, 2013; Cushman, 2013; Greene, 2017; Moore, 2011) cognition.

1.2 Contributions of this research

We investigate these questions by measuring intuitive preferences for moral foundations *when in conflict with one another*, as opposed to the widely accepted/used approach of asking participants how important each foundation is in isolation (Graham et al., 2011). This is particularly relevant in the context of findings that explicit hypothetical moral judgments do not predict 'real life' moral judgments or behaviour (Bostyn, Sevenhant, & Roets, 2018). We seek to isolate and explore the nature of such intuitive conflicts in order to bridge this theoretical gap. Thus, we seek to address existing limitations in testing the intuitive base of moral foundations, and help inform debate about the nature and dynamic interaction of moral intuitions.

This thesis presents an important first step in investigating these questions, using a novel task designed to measure deeper, intuitive conflicts between foundations. Thus, our intended contribution is multifold. Firstly, we seek to develop the first, and possibly best, way to trigger such intuitive conflicts as cleanly as possible. Secondly, we seek to validate this task against the Moral Foundations Questionnaire (Graham et al., 2011), as a well-established measure of (explicit) foundation preferences. Thirdly, we seek to probe the assumptions of the task in order to show that it is stable over multiple manipulations that are directly relevant to the claims of an intuitive level of measurement. Finally, we seek to show that the task makes a unique contribution in capturing foundation preference that is separate from that of the Moral Foundations Questionnaire. Fundamentally, we hope to provide, not only a methodological tool, but also a means to address deeper theoretical questions, that will provide opportunities to push models of moral judgment forward in exciting new ways.

1.3 Overview of this thesis

In Chapter 2, we give an overview of the development of Moral Foundations Theory as an explanation of moral diversity, the evidence for multiple, distinct, and intuitive foundations that drive moral judgment, and an overview of the theoretical and methodological gaps we seek to address in developing a way to target and measure intuitive-level conflicts between foundations. In Chapter 3, we give an overview of the development and structure of the Moral Foundations Conflict Task (MFCT), as a means to address these gaps. In Chapter 4, we provide an overview of the analytic approach we have taken with the patterns of responses and response data produced by the MFCT and in validation against response patterns on the Moral Foundations Questionnaire (MFQ). Here, we also provide rationale for an Ex-Gaussian approach to analysing response time data that isolates conflict in decision processes. Chapters 5 through 8 represent a set of five empirical studies applying this analytical approach. In Chapter 5, we test whether patterns of responses on the MFCT reflect responses measured by the MFQ (Study 1). Moreover, we explore whether preferences for foundations, as measured on both the MFQ and on the MFCT itself, predict response time distributions for choices that would be expected to incur greater conflict, and seek to replicate these findings in Chapters 6 to 8. In Chapter 6, we test the assumptions of the MFCT as an intuitive-level of measurement by manipulating cognitive load on the task in two ways, through a concurrent tone-counting task (Study 2) and after alcohol consumption (Study 3). In Chapter 7, we manipulate attention in the other direction, instructing participants to deliberate their choices on the MFCT (Study 4). In Chapter 8, we test whether we can replicate foundation preferences on the MFCT with three established correlates of the MFQ (Study 5). Finally in Chapter 9, we discuss the findings from this empirical body of work, provide an overview of its contribution and limitations, and outline potential future directions.

2 Chapter 2: Literature Review

2.1 General Background

In recent decades, psychologists have embarked on a descriptive and empirical campaign exploring moral judgment and behaviour. Drawing from evolutionary and cultural psychology, Moral Foundations Theory (MFT) presents a social psychological framework for examining the mechanisms that lead groups and individuals to hold divergent moral beliefs and values. Understanding moral disagreement is arguably one fundamental goal of the moral psychologist. A glance at most recent political debates shows that people characterise their own views as ethically untainted, and the views of the opposition as dangerous and immoral. Understanding what drives this implacability, and how we might achieve common ground, are key goals for the moral foundations theorist (Graham et al., 2013).

MFT proposes that an evolutionary history of consistent adaptive challenges that face socially living hominids has resulted in a set of psychological foundations that underpin morality, the expressive intensities of which vary across individuals, groups, and cultures as a function of social experience (Graham et al., 2013; Haidt & Joseph, 2004). These foundations, and their associated adaptive challenges, are: (1) care – concerns about protection and preventing suffering, evolved from a need to nurture young and care for vulnerable kin; (2) fairness – norms of reciprocity, from a need to secure the benefits of dyadic cooperation; (3) loyalty – concerns associated with social group membership, from a need to secure the benefits of group cooperation; (4) authority – concerns about obeying superiors, protecting subordinates, and respecting traditions, from a need to negotiate social hierarchies; and (5) purity – concerns about physical and spiritual purity, from a need to avoid contamination and disease. In addition to these five, liberty has been proposed as a sixth candidate that centres on reactance and resentment towards domination and restriction (Iyer, Koleva, Graham, Ditto, & Haidt, 2012).

MFT posits that moral foundations are innate, automatic, intuitive and affective, and thus, our moral judgments, and our moral disagreements, are a function of visceral, automatic, and emotional responses to moral stimuli in these five distinct domains (Graham, 2010; Graham et al., 2013; Haidt, 2001; Haidt & Joseph, 2004). However, despite this commitment to intuitionism, most MFT research is conducted using explicit self-report measures such as the Moral Foundations Questionnaire (Graham et al., 2011). The following literature review provides an overview of the key theoretical claims, empirical applications, and methodological approaches that have been developed within the context of MFT. Thus, we demonstrate the existing gaps in addressing questions about the processing of foundations at an intuitive level, particularly in the processes that occur as foundations clash within individuals. It is our view that methodological development in this area could help drive forward key debates about the nature and structure of moral foundations.

2.2 Moral Foundations Theory

Classic models of moral judgment have maintained a narrow focus on what counts as 'moral', typified by the debate between Kohlberg (1971, 1973), whose rationalist model places justice as the pinnacle of moral development, and Gilligan (1982) who instead proposed an ethics centred on care. In this context, concerns about values such as purity, patriotism, and deference to authority were consigned to a non-moral status as social conventions (Turiel, 1983; Turiel, Hildebrandt, Wainryb, & Saltzstein, 1991) on the basis that moral status should be reserved for universal values about how *individuals* ought to relate to one another.

Building on previous anthropological work on values pertaining to group membership, institutions and traditions, and divinity and worship (Shweder, 1990; Shweder, Much, Mahapatra, & Park, 1997), MFT was developed to explain variation in virtue concepts across cultures (Haidt & Joseph, 2004) in terms that do not exclude concerns about *groups* (Graham et al., 2013; Graham et al., 2009). MFT proponents argue that scientific understanding of morality has maintained a narrow focus on concerns about individuals as a product of over-generalisation (Haidt, 2015; Haidt & Graham, 2007, 2009; Haidt, Graham, & Joseph, 2009) from non-representative western, educated, industrialised, rich, and democratic (WEIRD) samples (Henrich, Heine, & Norenzayan, 2010). In the context of WEIRD-based study, it is the *foundational* nature of moral foundations that has prevented typically 'liberal' psychologists from acknowledging moralities that do not align with their own.

MFT proposes that moral systems should instead be defined by their *function* as interlocking sets of values that bind moral communities and make social life possible (Graham & Haidt, 2010; Graham et al., 2013; Haidt & Kesebir, 2010). In doing so, MFT is committed to a number of theoretical claims about the nature of morality and foundations.

2.2.1 Theoretical claims

According to MFT, moral foundations constitute an innate 'first draft' of morality that is "organised in advance of experience" (Haidt & Graham, 2009, p.382, quoting Marcus, 2004, p.40). This 'first draft' results in multiple 'hardwired' aptitudes for learning specific responses to recurrent social challenges (Graham et al., 2013; Haidt & Joseph, 2004, 2007), providing an innate structure that constrains the moralities that can be formed across cultures, with specific foundations being tuned-up or down by cultural and developmental learning. In this sense, MFT makes distinctions between *original triggers* – the social challenges a foundation has evolved to detect – and modern-day *current triggers* (see Table 2.1). MFT draws on evolutionary psychology (Cosmides & Tooby, 1994; Fodor, 1983) to suggest this is realised by sets of related adaptive modules (Haidt & Joseph, 2007), though this has been a source of criticism (Suhler & Churchland, 2011). Theorists argue that a modular view of the mind is not necessary to accept the general principles put forward in MFT (Haidt & Joseph, 2011). In this way, MFT accounts for cross-cultural similarities and also for divergences. This view of morality converges with arguments arising in developmental work suggesting that innate and adaptive aspects of morality are present from birth, and combine with learning and experience to create a culturally-specific morality in adult life (Hamlin, 2013; Hamlin, Wynn, & Bloom, 2007).

In addition to theoretical claims of nativism, pluralism, and cultural learning, MFT is committed to intuitionism. Drawing from Haidt's (2001) social intuitionist model, MFT holds that moral judgments tend to occur as a result of automatic and non-conscious intuitions, rather than by explicit and deliberative reasoning (Haidt, 2001; Haidt & Joseph, 2004). Thus, moral foundations drive moral judgment on the basis of intuitive and affective responses to morally-relevant stimuli across multiple, and adaptive, domains. We will return to the intuitive and implicit nature of moral foundations, however we will first turn to a review of how this list of domains has been developed and measured.

Table 2.1. Moral foundations and their related adaptive challenges, original and current triggers, and intuitive responses, modified from Graham et al. (2013)

Foundation	Care	Fairness	Authority	Loyalty	Purity
Adaptive Challenge	Protecting offspring	Gaining reciprocal benefits	Forming beneficial relationships	Forming cohesive coalitions	Avoiding disease
Original Triggers	Suffering or distress of offspring	Cheating, co-operation, or deception	Signs of high or low rank	Threat to ingroup	Waste, signs of disease
Current Triggers	Vulnerability, neoteny (e.g. baby animals),	Fidelity, benefit scrounging	Employers, respected professionals	Sports teams, nationality, brands	Immigration, deviant sexuality
Intuitive Responses	Compassion, anger at perpetrators	Anger, gratitude, guilt	Respect, fear	Group pride, anger at traitors	Disgust

2.2.2 Developing a list of moral foundations

Early development of a list of foundations was informed by Shweder's tripartite theory (Shweder, 1990; Shweder et al., 1997), identifying three 'moral languages': an *ethic of autonomy* – relating to protecting individuals; an *ethic of community* – preserving groups and social order; and an *ethic of divinity* – protecting against degradation. Precursory empirical work to MFT related this model to the political domain, finding that liberals primarily endorsed *ethics of autonomy*, whereas conservatives made greater use of *community* and *divinity* concepts (Haidt & Hersh, 2001).

In the initial proposal of MFT, Haidt and Joseph (2004) extended Shweder's ethics to incorporate Fiske's (1992) Relational Models Theory (also Relationship Regulation Theory – Rai & Fiske, 2011), which proposes that a biologically innate set of mental templates regulate and motivate social relationships: *Communal Sharing* – caring for and supporting in-group integrity; *Authority Ranking* – maintaining hierarchical social group ranking; *Equality Matching* – achieving balance and reciprocity, and *Market Pricing* – calculating and responding to ratios that ensure rewards and punishments are proportional.

Thus, MFT was first proposed with four foundations (Haidt & Joseph, 2004): *suffering* (referred to here as care), *reciprocity* (fairness), *hierarchy* (authority), and *purity*. As the theory developed, a fifth foundation – *loyalty*, or ingroup – has been included (Graham & Haidt, 2010; Graham, Haidt, & Rimm-Kaufman, 2008; Haidt & Graham, 2007; Haidt et al., 2009; Haidt & Joseph, 2007). More recently, *liberty* has been proposed as a sixth foundation, following empirical work on distinct facets of libertarian affective and cognitive dispositions (Iyer et al., 2012). In line with MFT's commitment to pluralism, this list is not intended to be comprehensive or complete, and it is expected that it will be revised and extended as future candidates for 'foundationhood' emerge. The Moral Foundations Questionnaire (MFQ) was designed to measure the first five foundations in the theoretical framework of MFT (Graham et al., 2011), and it is this version has been most widely applied to probe the internal and external validity of the model. On this basis, we focus here on the foundations of care, fairness, authority, loyalty, and purity.

2.2.3 Measuring five moral foundations

At its core, MFT was developed to explain moral variation, and thus a key context in which MFT has been developed and applied is in explaining so-called 'culture wars' between liberals and conservatives. MFT predicts that the intractability of these ideological and moral disputes can be explained by differences in patterns of the five moral foundations: liberals focus on individualising foundations of care and fairness, while conservatives place emphasis on all five foundations, including the binding foundations of authority, loyalty and purity (Graham, 2010; Graham et al., 2009; Haidt & Graham, 2007). This prediction has been demonstrated in a number of contexts, including with representative US samples (Franks & Scherr, 2015), and across cultures (Graham et al., 2009; Milesi, 2016, 2017; Nilsson & Erlandsson, 2015; Van Leeuwen & Park, 2009). We revisit this central prediction in Chapter 8.

The MFQ was developed as an individual differences measure of foundation endorsement, with early versions applied, in conjunction with other methods, to test this hypotheses about ideological differences (Graham, 2010; Graham et al., 2009;

Haidt & Graham, 2007). The first version of the MFQ (Graham et al., 2009, Study 1) asked for explicit ratings of the moral relevance of abstract foundation-related concerns, e.g. 'Whether or not someone did something to betray his or her group', with a second version (Graham et al., 2009, Study 2) adding a new section assessing agreement with more contextualised moral statements, e.g. 'People should not do things that are disgusting, even if no one is harmed'. Final items were selected with the large online samples (using ProjectImplicit.org, total *N* = 3,825) collected in Graham et al. (2009), using confirmatory factor analysis and correlations with three criterion scales (Graham et al., 2011).

This final 30-item version of the MFQ was further tested with a large cross-national sample (collected on YourMorals.org, total *N* = 34,476). In both of these samples, MFT's five-factor solution fit the data better than alternative models, including three-factor (corresponding to Shweder's tripartite theory), two-factor (individualising vs. binding) and single factor models (Graham et al., 2011). The five-factor model has been replicated in both WEIRD (Davies, Sibley, & Liu, 2014; Métayer & Pahlavan, 2014; Nilsson & Erlandsson, 2015) and non-WEIRD (Berniūnas, Dranseika, & Sousa, 2016; Yilmaz, Harma, Bahçekapili, & Cesur, 2016; Zhang & Li, 2015) cultures. Furthermore, using a short-form of the MFQ, Doğruyol, Alper, and Yilmaz (2019) found that a five-factor model is a good fit across 30 WEIRD and non-WEIRD countries, performs better than a two-factor model, and is stable, i.e. satisfies configural measurement invariance.

However, a number of studies challenge this five-factor structure, finding it to be a poor fit in non-WEIRD contexts (Davis et al., 2016; Yalçındağ et al., 2017). A recent study by Iurino and Saucier (2020), also using the short form of the MFQ, showed measurement non-invariance across 27 countries, suggesting that the five-factor model is not cross-culturally valid. Further research has suggested that a two-factor model is, in fact, plausible (Napier & Luguri, 2013; Van Leeuwen & Park, 2009; Wright & Baril, 2011; Yilmaz, Harma, et al., 2016).

In summary, there is strong support for the validity and reliability of the MFQ as a measure of five, distinct, moral foundations. However, there has also been sufficient contradictory evidence to fuel debate about the structure of moral foundations.

2.2.4 Challenges to Moral Foundations Theory

There have been a number of key challenges to MFT, that centre on disagreement about the number, and status, of moral 'foundations'.

According to MFT, moral foundations are multiple, distinct and differentially-activated. Over recent years, MFT has been challenged on this claim by the theory of dyadic morality (TDM – Schein & Gray, 2017; Schein & Gray, 2015), which proposes that all five 'foundations' are instead manifested by a single harm-based template, rather than by differing patterns of distinct moral foundations (Schein & Gray, 2015). Under this view, liberal-conservative disagreement is the result of differences in perceived harm.

Under TDM, the perception of harm involves intuitive judgments about the intention of the perpetrator, or agent, and the suffering of the victim, or patient (Schein & Gray, 2017; Schein & Gray, 2015; Gray, Waytz, & Young, 2012). The harm template is an evolved response to counter-normative acts, where instances are judged against this dyadic agent-patient harm template to assess for match, with closer matches being more robustly categorised as immoral. This view bears parallels with others proposing that similar kinds of templates, or representations, of moral agents play a central role, for example on the basis of inferences about an agent's intentions, and meta-intentions (Pizarro, Uhlmann, & Salovey, 2003), or to formulate causal models of moral behaviour (Sloman, Fernbach, & Ewing, 2009).

MFT has also been challenged on its structure based on the status of the binding foundations. It has been suggested that an individualising foundation (aggregating care and fairness) and a binding foundation (aggregating authority, loyalty, and purity) sufficiently explain MFQ data (Van Leeuwen & Park, 2009; Wright & Baril, 2011; Yilmaz, Harma, et al., 2016). Furthering this support for a two-factor structure, a number of researchers have argued that, rather than being distinct 'moral' domains, binding foundations are manifestations of cognitive processes that underlie ideological attitudes. Preferences for authoritarianism (i.e. right-wing authoritarianism) and group-based inequality (i.e. social dominance orientation) share psychological antecedents with endorsement of binding foundations (Van Leeuwen & Park, 2009). Furthermore, Kugler et al. (2014) found that ideological differences in foundation endorsement are partially attributable to differences in right-wing authoritarianism and social dominance orientation, adding to a number of previous studies showing similar associations (Federico, Weber, Ergun, & Hunt, 2013; Hadarics & Kende, 2017; McAdams et al., 2008; Milojev et al., 2014; Yilmaz & Saribay, 2017a).

This research is consistent with conceptions of political conservatism as motivated by a number of epistemic needs, that include an intolerance of ambiguity, uncertainty avoidance, and needs for order, structure, and cognitive closure (Jost, Glaser, Kruglanski, & Sulloway, 2003). Here, evidence converges in ideological differences in cognitive style, and tendencies to think more rationally versus more intuitively, that have been linked to ideological differences in foundation endorsement (Garvey & Ford, 2014; Napier & Luguri, 2013; Pennycook, Cheyne, Barr, Koehler, & Fugelsang, 2014; Wright & Baril, 2011; Yilmaz & Saribay, 2017a). This work seeks to uncover which foundations are 'core' by exploring and manipulating the effects of cognitive load and analytical thought. However, there is conflicting evidence in this context, with failures to replicate (Graham et al., 2013), and inconsistent effects (Van Berkel, Crandall, Eidelman, & Blanchar, 2015).

These contradictory findings in exploring moral foundations at an intuitive level will be discussed further in the following section. However, they have been attributed, in part, to features of the MFQ as a measure that does not include reverse-coded items (Jost, 2012; Yilmaz & Saribay, 2017a). Given that agreement with any given statement is more likely under intuitive thought (Knowles & Condon, 1999), higher scores on all items in the MFQ are more likely under cognitive load. This artefact has also been connected as a confound to ideological differences in foundation endorsement arising from ideological differences in cognitive style.

Challenges to MFT tend to agree that moral judgment is driven by fast intuitive processes, but disagree on the structure, and nature, of these processes. These critiques not only present a significant challenge to MFT, but also pose important theoretical questions about the nature of the moral domain. A central, and practical, way to help resolve these issues has been to look at patterns of responses on the MFQ, as a validated measure of foundations. However, the MFQ is an explicit self-report measure and there are thus central questions about the intuitive processing of moral foundations that it is unable to adequately address. We will now turn to a review of this literature.

2.3 Moral Intuitions

According to MFT, moral judgments are primarily driven by innate, intuitive foundations. A variety of work has elucidated the qualities of moral 'intuitions'. Many definitions of moral intuitions make contrasts with consciously-controlled moral reasoning (Kauppinen, 2015). In Cushman, Young, and Hauser (2006), a defining feature of moral intuitions is that they persist despite "insufficient justification", "uncertainty about how to justify", or "confabulation of alternative explanations for judgments", and contrast this with conscious reasoning in which the "principles used in judgments are articulated in justifications" (p.1083). According to Haidt (2001), moral intuitions result in the "sudden appearance in consciousness of a moral judgment… without having any conscious awareness of having gone through steps of search, weighing evidence, or inferring a conclusion" (p.818). These definitions emphasise *inaccessibility* to conscious reasoning as a key element of moral intuitions, and a variety of empirical work has sought to interrogate what kinds of moral judgments are driven by such inaccessible intuitive processes (Cushman & Greene, 2012; Cushman et al., 2006; Greene et al., 2004; Haidt, 2001; Moore et al., 2008; Moore et al., 2011). In addition to inaccessibility, Haidt (2001) outlines a number of other features of intuitive processing that include that it: is "fast" (*speed*); "is unintentional and runs automatically" (*automaticity*); and "does not demand attentional resources" (*cognitively effortless*) (p.818). The conception of moral foundations as intuitive processes draws from these definitions.

Foundations are theorised to operate as clusters, or "learning modules", of "little bits of input-output programming" that connect perceptions of morally-relevant patterns in the social world to an evaluation (Haidt & Joseph, 2007, pp.379-380). These processes produce moral intuitions – flashes of affective approval or disapproval – and it is these intuitions that drive our moral judgments, beliefs and actions. This is an important departure from classical views of morality in philosophy (e.g. Kant, 1785/1998) and psychology (e.g. Kohlberg, 1971, 1973) which have focused on reason as the driver of moral judgment.

2.3.1 Intuitive-level moral foundations

As an intuitionist theory, research on implicit and intuitive foundation-related moral judgment provides important evidence for MFT. There is a range of evidence that foundations operate at an intuitive level, and differentially predict moral decisions. Facial micro-expressions predict foundation-related judgments, e.g. anger expressions predict increased care-related condemnations, while disgust micro-expressions predict condemnation on purity and fairness (Cannon, Schnall, & White, 2011). Manipulating foundation-relevant intuitions and emotions, outside of conscious awareness, has also been shown to yield expected effects. Much of this research centres on disgust, as a purity trigger, and includes manipulations of incidental disgust (Horberg, Oveis, Keltner, & Cohen, 2009; Schnall, Haidt, Clore, & Jordan, 2008); differences in disgust sensitivity (Inbar, Pizarro, Knobe, & Bloom, 2009); hypnotic disgust (Wheatley & Haidt, 2005); and effects of cleansing actions, such as hand washing (Schnall, Benton, & Harvey, 2008; Zhong, Strejcek, & Sivanathan, 2010). Furthermore, a number of studies have found ideological and attitudinal effects with regard to implicit processing. Helzer and Pizarro (2011) found participants reported more conservative political orientations in the presence of visual reminders of physical purity (e.g. hand sanitizer), and differences in disgust sensitivity predict intuitive negativity towards gay people (Inbar et al., 2009). However, given work indicating the non-replicability of social priming effects that activate similar attitudes and stereotypes (Doyen, Klein, Pichon, & Cleeremans, 2012; Schimmack, Heene, & Kesavan, 2017; Shanks et al., 2013), these findings should be cautiously interpreted.

This evidence suggests that foundations operate and can be manipulated at an automatic level outside of conscious control to yield expected effects that are consistent with the MFT model. However, this work has focused on implicit processing of single foundations, and mainly just purity. It provides little insight into the structure of moral intuitions and how multiple, distinct, intuitive foundations might dynamically interact with each other. Here, there is a body of work that draws from dual-process theories of morality to probe questions of the structure of foundations, and the intuitive nature of foundations, by exploring how they relate at implicit and explicit levels. To situate MFT within this literature, we include a brief overview of dual-process models.

2.3.2 Dual-process models of moral judgment

Dual-process models essentially argue that human cognition functions on the basis of two types of systems (Evans & Stanovich, 2013): an automatic, intuitive, and low-effort System 1; and an analytic, consciously-deliberated, and effortful System 2 (Kahneman, 2011). Dual-systems theory has been applied to explain a number of attitudes as arising from intuitive System 1 thinking because they have been acquired in socialisation as opposed to through logical inquiry, including social conservatism (Deppe et al., 2015; Talhelm et al., 2015; Yilmaz & Saribay, 2017b), and religious belief (Pennycook, Cheyne, Seli, Koehler, & Fugelsang, 2012; Pennycook, Ross, Koehler, & Fugelsang, 2016; Shenhav, Rand, & Greene, 2012; Yilmaz, Karadöller, & Sofuoglu, 2016).

Dual-process models have also been applied to moral judgment (Crockett, 2013; Cushman, 2013; Cushman & Greene, 2012; Greene et al., 2004; Haidt, 2001; Moore et al., 2008; Moore et al., 2011). Arguing for a central role of intuitive processes, Haidt's (2001) social intuitionist model has been a major influence on MFT, and emphasises cultural and social influences in shaping moral intuitions that drive moral judgment. Here, deliberative System 2-type reasoning is typically employed as post-facto rationalisation in order to justify initial intuitive moral responses (Haidt, 2001; Mercier & Sperber, 2011). Table 2.2 outlines the distinguishing features of System 1 versus System 2-type processes. In particular, as discussed above, the features of inaccessibility, speed, automaticity, and cognitive effortlessness contrast with the consciously accessible, slow, controllable, and attentionally demanding nature of System 2 reasoning. It is also worth highlighting the distinction between the parallel intuitive processing of Sytem1 and the serial processing of System 2 – we return to this point below to consider questions around how multiple foundations might operate at the intuitive level.

Table 2.2. General features of the intuitive and reasoning systems, modified from Haidt (2001)

Intuitive system (System 1)	*Reasoning system (System 2)*
Fast and effortless	Slow and effortful
Process is unintentional and runs automatically	Process is intentional and controllable
Process is inaccessible; only results enter awareness	Process is consciously accessible and viewable

Does not demand attentional resources	Demands attentional resources, which are limited
Parallel distributed processing	Serial processing
Pattern matching; thought is metaphorical, holistic	Symbol manipulation; thought is truth preserving, analytical
Common to all mammals	Unique to humans over age 2 and perhaps some language-trained apes
Context dependent	Context independent
Platform dependent (depends on the brain and body that houses it)	Platform independent (can be transported to any rule following organism or machine)

Other dual-system models place reasoning processes in a more prominent role than Haidt (2001), positing that moral judgment is a result of two distinct neural systems: An automatic, action-based, affective system and an abstract reasoning, outcome-based, system (Crockett, 2013; Cushman, 2013; Cushman & Greene, 2012; Greene et al., 2004). These models make predictions about the kinds of moral judgments that differentially engage these two distinct systems. In particular, utilitarian (consequence-based) responses to trolley-type dilemmas entail greater recruitment of cognitive control regions of the prefrontal cortex compared to deontological (rule-based) responses, and take more time to make (Greene et al., 2004; Greene et al., 2001), become less likely under cognitive load (Greene, Morelli, Lowenberg, Nystrom, & Cohen, 2008), and more likely under deliberation (Paxton, Ungar, & Greene, 2012). These models have also been applied to predict why, and when, instances of cognitive conflict arise in moral judgment, how this can lead to notably different judgments in seemly similar moral problems (Cushman & Greene, 2012; Moore et al., 2008; Moore et al., 2011), and how that conflict may be resolved by engaging cognitive and reflective processes (Kahane, 2012).

In summary, understanding how multiple, distinct and intuitive foundations operate in moral judgement is an important aspect of MFT, however most of the empirical research on the intuitive processing of foundations does not address this question directly. In the wider literature on dual-process models, moral intuitions have been defined via a number of key aspects: they are the result of inaccessible, fast, automatic, and effortless processes. Furthermore, under these views, moral intuitions co-exist in parallel, and when they conflict with one another, this is detected and resolved by System 2-type processes. However, this work on dual-process models does not address whether, and how, intuitions might compete at the intuitive level, *before* controlled and reflective cognitive processes are engaged.

It has, however, provided a framework in which to begin to address questions about the structure of moral intuitions, and how these might relate to consciously-endorsed values and beliefs.

2.3.3 Relating intuitive and reflective moral foundations

There are several possibilities with regards to how the intuitive and reflective levels of foundations might relate. In this regard, we will discuss what we interpret as three alternative views in the literature: (1) differences that emerge in consciously-endorsed values merely reflect differences in intuitions; (2) everyone has intuitions based on all five foundations, but selectively and effortfully suppress intuitions not in line with consciously-endorsed values; and (3) everyone has intuitions based on a few ‘core’ foundations, but other apparent ‘foundations’ – the binding foundations – are manifestations of selective and effortful enhancement to satisfy other ‘non-moral’ motives. While the former two possibilities are compatible with the theoretical commitments of MFT, the latter presents a challenge related to critiques of the theory. Previous work has tended to approach this question through political ideology, and there is conflicting support for each of these proposals. Here, we present these alternatives as distinct to highlight the tensions between them that particularly focus on disagreement about the status of the binding foundations. However, we also acknowledge that there may be conceptual overlap between them.

In support of proposal (1), Graham et al. (2009) argue that liberals and conservatives have different intuitive moralities and that this accounts for differences in endorsed values. This view is supported by findings that ideology has a strong heritable component (Alford, Funk, & Hibbing, 2005), and is developed based on environmental and cultural factors (Hess, Torney, & Valsiner, 2006), suggesting a feedback loop between ideology and moral intuitions (Graham, 2010). Under this view, everyone has intuitions based on all five foundations, but differ in the levels of import they intuitively place on each, and these intuitive differences manifest in their conscious endorsements.

There is also work advocating proposal (2). Skitka, Mullen, Griffin, Hutchinson, and Chamberlin (2002) found that under cognitive load, liberals’ attributions concerning victims become more like those of conservatives, but that liberals correct for these when they conflict with their explicit ideological values. Applied to moral foundations, this 'motivated correction' hypothesis proposes that conservatives and liberals share similar intuitive moral values based on binding foundations, but that liberals actively suppress these because they conflict with their consciously-endorsed care and fairness concerns. Under this view, everyone has intuitions based on all five foundations, but work to suppress those not in line their consciously-endorsed values.

However, other studies have compounded this research, and instead advocate for proposal (3). They find that cognitive load had the opposite effect, with conservatives scoring lower on the binding foundations (Wright & Baril, 2011). This finding is contextualised within a 'motivated social cognition' approach (Jost et al., 2003), suggesting that, rather than liberals effortfully suppressing binding intuitions, conservatives effortfully enhance binding foundations to satisfy a number of other motives, including a resistance to change, and opposition to equality (Jost, 2012). In its strongest form, this view suggests that everyone possesses 'core' individualising intuitions based on care and fairness, and that the binding 'foundations' in fact manifest as a result of explicit-level processes to satisfy these other, non-moral, motives. However there are inconsistent effects, with findings failing to replicate in two further studies (Graham et al., 2013), or instead showing increased endorsement of care and authority under load conditions, regardless of political orientation (Van Berkel et al., 2015).

It remains difficult to disentangle (2) and (3) based on existing evidence. Converging support for (2) comes in the form of individual differences in tendencies to think more rationally and less intuitively (Garvey & Ford, 2014; Royzman, Landy, & Goodwin, 2014) and higher cognitive ability (Pennycook et al., 2014) predicting reduced condemnation of binding-related violations, and decreased endorsement of binding foundations. Some studies that manipulate analytical thinking, rather than cognitive load, instead support proposal (3). Napier and Luguri (2013) reported an increase in endorsement of individualising foundations and a decrease in binding foundations for both liberals and conservatives, as a result of manipulating abstract (vs. concrete) thinking. In this case, it is unclear whether the abstract versus concrete distinction maps directly on to analytical versus intuitive thinking. To explore this, Yilmaz and Saribay (2017a) found that, when encouraged to engage in effortful analytical thinking, people place more value on individualising foundations, regardless of political orientation, but that – counter to expectations – there was no shift in the value placed on binding foundations.

Furthermore, in support for proposal (2), a number of other studies suggest that liberals resemble conservatives when they adopt a more intuitive cognitive style under situations of threat and mortality salience (F. Cohen, Ogilvie, Solomon, Greenberg, & Pyszczynski, 2005; Nail, McGregor, Drinkwater, Steele, & Thompson, 2009), and that mortality salience acts as a kind of high cognitive load that in turn impacts moral judgments (Trémolière, De Neys, & Bonnefon, 2012). Testing representative samples before and after the 2005 London bombing, Van de Vyver, Houston, Abrams, and Vasiljevic (2016) found that endorsements of loyalty increased, while fairness decreased, and that this change occurred more strongly for liberals than conservatives. Linking to work showing that terrorist attacks have effects similar to mortality salience manipulations (Landau et al., 2004), events like the 2005 London bombing may thus operate as a form of cognitive load that has asymmetrical effects on liberals and conservatives, interfering with the former's ability to suppress moral foundations that conflict with consciously-endorsed values. If differences in consciously-endorsed values are simply differences in intuitive responses to moral stimuli then we would not expect these asymmetrical effects of increased System 2-type thinking. However, recent work suggests that literature on priming effects, including mortality salience, suffers from low replicability (Klein et al., 2019; Schimmack et al., 2017). This includes a multi-lab replication (Klein et al., 2019) that was unable to replicate a classic effect of mortality salience on worldview defence (Greenberg, Pyszczynski, Solomon, Simon, & Breus, 1994), though subsequent analysis suggests that effects may replicate in the larger samples included in this project (Chatard, Hirschberger, & Pyszczynski, 2020). However, these questions around replicability present sufficient reason to interpret these findings with caution.

Graham (2010) proposes a hypothesis in between proposals (1) and (2). Across five studies exploring different levels of awareness, ranging from self-reported gut reactions to automatic neural responses, liberals had a greater discrepancy between explicit and implicit foundations, compared to conservatives. Specifically, though liberals endorse binding foundations less than conservatives at the explicit level, this difference diminishes at the implicit level, or under cognitive load (Graham, 2010), suggesting that liberals are effortfully suppressing binding foundations. However, liberals and conservatives were also found to implicitly differ in the same directions that they explicitly differ (Graham, 2010), suggesting that explicit-level foundations do reliably map on to implicit-level foundations. Here, there may also be some conceptual overlap with proposal (3), related to the notion of 'morality shifting' (Leidner & Castano, 2012), whereby groups shift their values, from individualising concerns about care and fairness to binding concerns of loyalty and authority, when under threat, and that this shifting process can occur as automatic framing. As such, it may be possible to reconcile elements of all three proposals, suggesting that while everyone has moral intuitions beyond those of care and fairness, certain contexts may result in motivations to either suppress or enhance foundations.

In summary, there is a range of, somewhat conflicting, evidence about how multiple moral foundations manifest at the intuitive-level, and how these might relate to consciously-endorsed foundations. Generally, these divergent views agree – though to different extents – that foundation-related intuitions will be systematically and reliably linked to explicit foundations, but disagree on how this operates, and in particular whether the binding foundations have the same status as moral intuitions as the individualising foundations. Studies investigating foundation intuitions have tended to explore effects as mediated through political ideology, and there is therefore a lack of research directly addressing this question. The majority of this prior work has relied on manipulating cognitive resources or style, and then testing effects on explicit-level foundation-related moral judgments (Pennycook et al., 2014; Royzman et al., 2014), statements (Van de Vyver et al., 2016), or on the MFQ (Garvey & Ford, 2014; Napier & Luguri, 2013; Van Berkel et al., 2015; Wright & Baril, 2011; Yilmaz & Saribay, 2017a). This approach is therefore confounded not only by previously discussed limitations of the MFQ, but by a general reliance on explicit self-report measures for addressing questions about intuitive-level moral foundations.

If foundations are fundamentally multiple, distinct, moral intuitions, these intuitions may compete at the intuitive-level, and how this competition arises and is resolved may be systematically related to how moral judgments unfold under deliberation. Attempting to capture this inter-foundation conflict, and understand more about how foundations are traded off against one another will help move theoretical development forward. We will now turn to work that has begun to explore these foundation trade-offs.

2.3.4 Moral foundation trade-offs

A number of studies have put forward the hypothesis that, when two foundations conflict, whichever is more strongly endorsed will guide moral judgment and behaviour. This 'moral trade-off' hypothesis has been shown to have predictive power in a number of domains (Dungan, Waytz, & Young, 2014; Monroe & Plant, 2019; Waytz, Dungan, & Young, 2013). Waytz et al. (2013) explore the 'whistleblowers' dilemma' as a trade-off between competing fairness and loyalty concerns, i.e. being fair, impartially reporting your company's unethical behaviour to a third party versus being loyal and staying silent. They found that individual differences in tendencies to value fairness versus loyalty, as well as a manipulation to enhance fairness concerns (a short essay on the importance of fairness/justice), increased willingness to engage in whistleblowing. They further hypothesise that this fairness versus loyalty tension is emblematic of deeper tensions between group-based (i.e. binding) and group-independent (i.e. individualising) moral norms (Dungan et al., 2014).

Monroe and Plant (2019) have applied this framework to predict perceptions of, and discrimination towards, sexual outgroups as tension between care and purity concerns. They show that preferentially endorsing purity over care predicts an increased tendency to dehumanise sexual outgroups, that include gay men, people with AIDS, prostitutes, and transgender people. In turn, this dehumanisation predicted discriminatory behaviour towards these groups, including prejudicial attitudes, expressing explicit and automatic prejudice, refusal to help, and acceptance of discriminatory public policies (Monroe & Plant, 2019). They also found that a manipulation to enhance care concerns (a short news audio clip emphasising care towards a non-sexual outgroup) reduced dehumanisation towards gay and transgender targets.

These studies demonstrate the predictive value of capturing differences in how people make foundation trade-offs. However, they mostly operationalise these trade-offs as self-reported relative preferences for foundations, either as a composite MFQ-based score, subtracting one foundation's score from the other (Monroe & Plant, 2018, Studies 1 & 2; Waytz et al., 2013, Study 1), as a composite score of trade-offs against non-moral goods, i.e. an amount of money (Monroe & Plant, 2018, Study 3), or a few items capturing forced-choice preferences for foundation-upholding third parties (e.g. 'Who would you rather be friends with?': 'Someone who is fair and just to others, who is impartial and unprejudiced regardless of how it affects their family and friends', Waytz et al., 2013, Study 1).

It is likely that these explicitly reported trade-offs are driven, at least in part, by intuitive-level conflicts between foundation-related concerns. Work on foundation trade-offs to date is marked by a reliance on explicit-level measures that do not directly probe at intuitive-level conflicts. Given avid debate on how intuitive and explicit levels of foundations relate, it remains unclear how foundations may be traded off against one another *at the intuitive-level*, and how this is reflected in explicitly reported moral foundations. As yet, there are no sufficient ways of addressing these questions. We turn now to a summary of the current methodological gaps.

2.4 Methodological Gaps

MFT is a framework for morality that proposes that multiple, distinct, variably-manifesting, and intuitive moral foundations drive moral judgment, and can account for variation in moral value endorsement. Additionally, MFT has been challenged on many of these theoretical claims. In the preceding review, we have argued that much of this debate hinges on limitations to current approaches, including a reliance on explicit self-report measures, and most predominantly the MFQ, to map individual moralities. Furthermore, these limitations also leave important theoretical questions unaddressed.

As an intuitionist theory, evidence for the intuitive base of moral foundations is important for MFT. A number of methodologies capturing both responses and response times have been used in order to bypass self-report and measure foundation-related intuitions more directly (Graham et al., 2013). Non-conscious processes connected to moral foundations have been investigated in neuroimaging studies (Cannon et al., 2011; Graham, 2010, Study 5), and by manipulating automatic foundation-related triggers (Helzer & Pizarro, 2011; Horberg et al., 2009; Schnall, Benton, et al., 2008; Schnall, Haidt, et al., 2008). Experimental methods have included: evaluative priming – foundation word primes flashed before positive/negative adjective targets (e.g. Graham, 2010, Study 3); affect misattribution – foundation image primes flashed before neutral character targets (e.g. Graham, 2010, Study 4); implicit association tests (IATs)

– automatic associations between foundation word primes (e.g. Schein & Gray, 2015, Study 4 & 7); and speeded foundation trade-off tasks – quick responses to dichotomous questions about foundation-violations (e.g. Graham, 2010, Study 2).

However, though these methods provide support for implicit foundation-related intuitions, most of these methodologies are limited to measuring implicit processes of single foundations, and most often purity (Helzer & Pizarro, 2011; Horberg et al., 2009; Schnall, Benton, et al., 2008; Schnall, Haidt, et al., 2008), independently of other foundations. MFT has been criticised in this regard for measuring foundations in isolation, despite the fact that real world moral judgment often requires decisions between values (Jost, 2012).

Of the methods listed, evaluative priming and affect misattribution techniques are vulnerable to this critique, being only able to assess one foundation at a time. IATs have been used to some effect to relate foundations. In support of a single harm-based moral domain, Schein and Gray (2015) apply an IAT paradigm to show that response times for judgments about whether an act was harmful were the best predictor of response times for whether an act was immoral (Study 4), and judgments of purity violations are more strongly associated with harm than with loyalty, a fellow binding foundation (Study 7a), and vice versa (Study 7c). These applications, though attempting to falsify MFT, begin to explore how foundation intuitions might relate to one another, though the former (Study 4) persists in measuring a single foundations, but in relation to a broader immorality concept. However, the IAT structure is limited to measuring the associations of two categories to a third category, over multiple trials, and thus would be an impractical and highly intensive approach to mapping out all possible foundation associations. It is also unclear whether implicit associations do in fact reflect intuitive preferences for foundations. Previous work on the race IAT has demonstrated the ambiguities of interpreting these associations (Andreychik & Gill, 2012; Uhlmann, Brescoll, & Paluck, 2006). Further work on the race IAT shows that scores are weak predictors of 'real world' discriminatory behaviour (Forscher et al., 2019; Greenwald, Poehlman, Uhlmann, & Banaji, 2009; Oswald, Mitchell, Blanton, Jaccard, & Tetlock, 2013), and any effects are simply too small to predict individual behaviour (Greenwald, Banaji, & Nosek, 2015).

Foundation trade-off approaches could address these issues, but have only been applied in a small handful of studies (Graham, 2010, Study 2; Graham et al., 2009, Study

3), and mostly to explore explicit-level trade-offs (Monroe & Plant, 2019; Waytz et al., 2013). These studies have either measured trade-offs as a composite of MFQ scores for two foundations (Monroe & Plant, 2018, Studies 1 & 2; Waytz et al., 2013, Study 1), or as isolated foundations in trade-offs against non-moral goods, i.e. amount of money required to motivate foundation violations (Graham et al., 2009, Study 3; Monroe & Plant, 2018, Study 3). In both cases, trade-offs *between* foundations are not being captured directly.

Graham (2010) uses a trade-off task that does probe this directly. In this task, participants saw dyads of brief descriptions of foundation-related violations – e.g. ‘Treating people unequally’ versus ‘Disobeying an authority’ – and were prompted to make dichotomous judgments about which was worse. However, in this context, this task was applied to evidence that ideological differences persisted when participants answered with their first gut reaction relative to when they deliberated these decisions, rather than to address questions about the intuitive processing of trade-offs between foundations. Building and expanding on the principles of the task developed by Graham (2010), we seek to develop and test a foundation trade-off task that addresses these methodological and theoretical gaps.

2.4.1 Other methodological concerns

In addition to these key gaps, we have identified two further methodological concerns that we seek to address in the development of the task.

Firstly, prior approaches – that do not base foundation endorsement on the MFQ – have tended to focus on foundation violations (e.g. Clifford, Iyengar, Cabeza, & Sinnott-Armstrong, 2015; Garvey & Ford, 2014; Graham, 2010, Study 2; Graham et al., 2009, Study 3; Landy, 2016; Royzman et al., 2014; Schein & Gray, 2015). Foundation-consistent virtues, on the other hand, are often neglected, and there has been mixed success in exploring intuitive-level virtues. Ferguson (2007) found that automatic associations of positivity with words like ‘fair’ and ‘equal’ predicted scores on the ‘motivation to avoid prejudice’ scale (Plant & Devine, 1998) and suggest that such associations reflect automatic goals for egalitarianism. However, Graham et al. (2009) unsuccessfully attempted to replicate these automatic priming effects with foundation-related virtue words. Prior research suggests that intuitive responses to foundation violations/vices and virtues may differ. Vices are expected to yield stronger, more reliable priming effects (Graham, 2010), and hold greater moral weight, attributable to a general negativity bias based on predispositions to assign greater weight to negative events (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Rozin & Royzman, 2001). Furthermore, items requiring trade-offs against non-moral goods (Graham et al., 2009, Study 3; Monroe & Plant, 2018, Study 3) are inherently only able to measure foundation violations, with no symmetrical equivalent for virtues.

Secondly, prior approaches have tended to either use descriptions of active foundation-related behaviour (e.g. Graham, 2010; Graham et al., 2009), i.e. 'Hurting someone's feelings' (Graham, 2010, Study 2), or passive descriptors of foundation-related traits (e.g. Graham, 2010; Graham et al., 2007) i.e. 'nurturing' or 'cruel', (Graham, 2010, Study 3). A body of work on a 'person-centred' approach shows a dissociation between moral judgments of an agent's action, and of their character (Tannenbaum, Uhlmann, & Diermeier, 2011; Uhlmann, Pizarro, & Diermeier, 2015). This action versus character distinction may indeed map on to a distinction between foundation-related active behaviours and passive traits, with different processes underlying these judgments. This research indicates the psychological primacy of character judgments, with automatic inferences about moral character emerging early in development and across cultures (Goodwin, Piazza, & Rozin, 2014; Hamlin et al., 2007; Lieberman, 2005; Willis & Todorov, 2006).

Based on this literature, we can reasonably expect that intuitive-level processing of vice, relative to virtue, and active, relative to passive, foundation-related concerns may differ. We have no specific predictions about how these differences will manifest in a trade-off task. However, we will include both foundation vices and virtues, and both active and passive formulations of foundation-related stimuli, in order to help address these asymmetries in the moral foundations literature, and ensure that we are comprehensively covering all the various facets of foundation intuitions.

2.5 Present Research

Despite emerging evidence of the predictive power of considering conflict between foundations, only a few studies have explored these processes even at the explicit-level, and to our knowledge, no work has examined the nature of such conflicts as they might occur and be resolved at the intuitive-level. Furthermore, where previous work has explored the nature of foundation-related intuitions, it has tended to do so by measuring foundations in isolation, or as mediated through political ideology. Little research has directly compared intuitive processing of moral foundations to self-reported endorsements of foundations. Thus, there is unexplored potential to use trade-off task methodologies (e.g. Graham, 2010, Study 2) to develop an intuitive version of self-report scales (like the MFQ) that provide indices of intuitive conflict in decisions between foundations, that not only map relative intensities of moral intuitions, but also provide new avenues for future research on inter-foundation conflict.

Across five studies, this thesis addresses existing gaps by developing and validating a novel trade-off task – the Moral Foundations Conflict Task (MFCT) – which aims to capture decisions between foundations that directly arise from intuitive-level conflict. Generally, we hypothesise that patterns of these intuitive trade-offs on the MFCT will be reliably related to deliberated endorsements of foundations, though we do not have an expectation about the magnitude of this association.

In Study 1, we test whether responses on the MFCT reflect explicitly-endorsed and deliberated endorsements on the MFQ. To address concerns that the MFCT may merely reflect quick, and noisy, explicit preferences for foundations, in Studies 2 and 3, we apply two manipulations of cognitive load to explore whether associations between responses on the MFCT and the MFQ are shifted. If trade-offs on the MFCT occur as a result of fast deliberative processes, rather than intuitive-level processes, then we would expect a shift, with a weaker correlation between the two under load. In Study 4, we instead manipulated deliberation on the MFCT, to explore whether correlations would shift in the opposite direction, as trade-offs on the MFCT were being made effortfully and explicitly, and thus more closely reflect the MFQ. Finally, in Study 5, we explore whether well-established effects with key correlates of the MFQ – political orientation, right-wing authoritarianism (RWA), and social dominance orientation (SDO) –.replicate with responses on the MFCT.

Across all studies, we probe the assumption that the task is capturing decisions between foundations that arise directly from intuitive-level conflict, by conducting exploratory analyses of response times (RTs). Here, we hypothesise that patterns of both intuitive (MFCT) and explicit (MFQ) foundation-endorsements will be reflected in the time required to make decisions between foundations. When foundations are closely valued, intuitive decisions between them will be more difficult and take longer, reflecting conflict. When they are unbalanced, intuitively choosing the more valued foundation will be more probable and response times will be faster.

It is worth noting here that, within the MFCT, we operationalise intuitive inter-foundation conflict as quick decisions between foundation-related words and phrases. In doing so, we emphasise *speed* – both in how participants are instructed to complete the task and in our analysis of response time data. Thus, we are able to capture systematic and repeated decisions between foundations, providing a metric of how consistent people were across all possible inter-foundation combinations. However, we acknowledge that speed is one of a number of key aspects of moral intuitions previously discussed, that includes inaccessibility, automaticity, and cognitive effortlessness. Through two of the following studies (Study 2 and 3), we seek to show that the speeded decisions on the MFCT are not affected when cognitive resources are limited, and hence motivate a claim that the MFCT is capturing the outcomes of not only quick, but also automatic and effortless, processes. However, our operationalisation and testing of the MFCT does not directly consider inaccessibility. We justify this on the basis that interrogating this aspect of intuitive decisions, i.e. by asking people to justify their decisions (e.g. Cushman et al., 2006), would likely have emphasised consistency and thus triggered deliberate self-presentation. We return to a discussion of this issue in the general discussion in Chapter 9.

3 Chapter 3: Development of the Moral Foundations Conflict Task

The Moral Foundations Conflict Task (MFCT) was created as part of a masters project (Ahluwalia, 2015) chronologically prior to the analyses and testing of the task described in Chapters 5 to 8. In this chapter, we provide an overview of this development.

3.1 Item development

To create the task, an initial list of 80 foundation-relevant words and phrases, 16 per foundation, were developed to fit into one of four formulations defined by orthogonally crossing valence (virtue/vice) and activity level (active/passive, or alternatively, action/trait) to create four blocks: (1) *virtue active* – describing active virtue behaviour, and completing the stem ‘It is better to’; (2) *virtue passive* – passive virtue traits, completing ‘It is better to be’; (3) *vice active* – active vice behaviour, completing ‘It is worse to’; and (4) *vice passive* – passive vice traits, completing ‘It is worse to be’. Words and phrases were adapted from the Moral Foundations Dictionary, which itself was developed from a text analysis study of moral rhetoric (Graham et al., 2009). Examples of items created for each block is provided in Table 3.1. A full list of items is provided in Table 11.1 in Appendix 1.

Table 3.1. Example items developed for blocks

Foundation	*Virtue Active*	*Virtue Passive*	*Vice Active*	*Vice Passive*
Care	Care for vulnerable people	Compassionate	Make other people suffer	Cruel
Fairness	Treat everyone equally	Unbiased	Treat some people differently	Unjust
Authority	Obey elders	Respectful	Show a lack of respect for authority	Rebellious

Loyalty	Show loyalty to friends	Patriotic	Act for selfish reasons	Unfaithful
Purity	Act with integrity	Virtuous	Behave indecently	Dirty

Note. Above sample items have been included here to indicate the breadth of items developed. Each item is one of four created per foundation for each block. All of these sample items appear in the MFCT.

3.1.1 Item pairings

In order to create closely-matched item pairings, length (number of letters) was recorded for each item. In addition, each item was scored by three independent coders for valence, i.e. how positive (for foundation virtues) or negative (vices) on a scale of 1 (*Not at all positive/negative*) to 7 (*Very positive/negative*), *intra-class correlation (ICC)* = .69, *95% CI* [.58, .77], F (79, 160) = 7.53, p < .001. There was no evident difference between valence ratings for virtue and vice items, *Mann–Whitney* U = 746.50, Z = -.51, p = .61, r = .06, nor between active and passive items, U = 761, Z = -.38, p = .71, r = .04. There were differences in valence ratings across foundations, *Kruskal Wallis* H(4) = 52.75, p < .001, with pairwise comparisons indicating that care (M = 5.88, SD = .40) and fairness (M = 6.23, SD = .45) items scored higher than authority (M = 3.75, SD = .60), loyalty (M = 4.31, SD = 1.23), and purity (M = 3.44, SD = 1.29) items, likely a reflection that coders were more liberal and thus placed higher importance on care and fairness items. Valence ratings from coders were averaged to give each item a valence score.

A final list of item pairings was developed to match items in each block based on their valence score and length. In order to do this, a table of the total 640 item combinations (160 possible combinations in each block) was created. For each inter-foundation combination in each block, item pairings were ordered first to minimise difference in valence score, and then to minimise a difference in length. The top four most closely matched items were chosen to create the final 160 pairings. Table 3.2 provides examples of item pairings that appear in each block. As a result of this process, five of the original 80 items were dropped because they did not occur in any matched pairs (see Table 11.1 in Appendix 1).

Table 3.2. Example item pairings for blocks on the MFCT

Block (Prompt)	*Item 1*	*Item 2*	*Foundation 1*	*Foundation 2*
Virtue Active (It is better to…)	Comply with people in authority	Protect defenceless animals	Authority	Care
	Be openminded about other people	Care for vulnerable people	Fairness	Care
	Protect defenceless animals	Show loyalty to friends	Care	Loyalty
	Act in a modest manner	Put family before yourself	Purity	Loyalty
Virtue Passive (It is better to be…)	Obedient	Patriotic	Authority	Loyalty
	Sympathetic	Unbiased	Care	Fairness
	Unbiased	Loyal	Fairness	Loyalty
	Dutiful	Pious	Loyalty	Purity
Vice Active (It is worse to…)	Act for selfish reasons	Cause chaos or disorder	Loyalty	Authority
	Act in an obstructive manner	Behave indecently	Authority	Purity
	Cheat to get ahead	Make other people suffer	Fairness	Care
	Act in an obscene manner	Treat some people differently	Purity	Fairness
Vice Passive (It is worse to be…)	Undisciplined	Neglectful	Authority	Care
	Rebellious	Unfair	Authority	Fairness
	Biased	Selfish	Fairness	Loyalty
	Selfish	Sinful	Loyalty	Purity

Note. Above sample item pairings represent a subset of the 40 item pairings (4 per inter-foundation combination) that appear in each block. The prompt used in each block is provided in parentheses.

There were no evident differences in the valence scores of paired items for virtue pairs (M = 1.02, SD = .85) or vice pairs (M = 1.08, SD = .94), U = 3259.5, Z = .20, p = .84, r = .02, indicating that items were evenly matched across these formulations. However, there were differences in valence scores between active and passive formulations, with a closer match in active (M = .66, SD = .66) compared to passive pairs (M = 1.42, SD = .94), U = 1621, Z = -5.41, p < .001, r = -.43.

Items were also not evenly matched on valence scores across inter-foundation combinations, $H(9)$ = 71.56, p < .001, with pairings between care or fairness, and authority, loyalty, or purity tending to have a larger difference. Again, this reflects higher ratings given for care and fairness. Descriptive statistics of the differences in valence scores across inter-foundation combinations is given in Table 3.3.

Table 3.3. Descriptive statistics of differences in valence scores across inter-foundation combinations and task blocks, modified from Ahluwalia (2015)

Foundation Combination	*Full Task*	*Virtue Active*	*Virtue Passive*	*Vice Active*	*Vice Passive*	*N*
Authority-Fairness	1.96 (.87)	2.50 (.19)	1.67 (.54)	.83 (.43)	2.83 (.19)	16
Authority-Purity	.38 (.36)	.17 (.19)	.75 (.50)	.17 (.19)	.56 (.27)	16
Care-Authority	1.65 (.83)	1.58 (.32)	1.33 (.61)	.83 (.19)	2.83 (.19)	16
Care-Purity	1.62 (.88)	.83 (.43)	2.25 (.69)	.92 (.32)	2.50 (.19)	16
Fairness-Care	.19 (.17)	.00 (.00)	.25 (.17)	.17 (.19)	.25 (.17)	16
Fairness-Loyalty	.85 (.54)	1.25 (.17)	1.00 (.90)	.42 (.32)	1.56 (1.57)	16
Loyalty-Authority	.75 (.68)	.17 (.19)	.83 (.19)	.25 (.17)	1.75 (.32)	16
Loyalty-Care	.60 (.59)	.50 (.43)	.92 (.96)	.28 (.25)	.83 (.33)	16
Purity-Fairness	1.60 (1.01)	.42 (.17)	2.33 (.77)	1.17 (.69)	.75 (.17)	16

Note. Valence scores are on a 1 to 7 scale, and thus the difference in valence scores for an item pairing could range from 0 to a possible maximum of 6. *SD*s are provided in parentheses.

Within subsequent analyses in Studies 1 to 5, we have included, either in text or appendices, models that explore the effects of length and valence score, and of item blocks, on responses and response times on the task. To preview those results, overall the MFCT remains stable across blocks, and can be reliably analysed at the global level.

4 Chapter 4: Overview of analytic approach

In the studies that follow, we test various properties of the Moral Foundations Conflict Task (MFCT), and how it relates to other measures of moral values and attitudes. In doing so, we develop a general analytic approach and implement this for each study. In this chapter, we provide an overview of this general approach.

Across the studies that follow, we consider two kinds of data generated by the MFCT: (a) responses, as the proportion each foundation is chosen across the task; and (b) response times (RTs) for these choices. For each study, results are broadly reported in three main sections. Firstly, we consider the properties and structure of the task itself, exploring whether responses and RTs differ based on the valence score and length of items (see development of the task discussed in Chapter 3), and based on the four item blocks in the task, orthogonally crossing whether items describe foundation virtues/vices and are in active/passive formulations. Secondly, we consider correlations between scores for foundations measured on the MFCT and those measured within the Moral Foundations Questionnaire (MFQ). Finally, we consider patterns in RTs on the MFCT and how these relate to scores both from the MFQ and from the task itself.

Here, we outline the analytic approach applied consistently and repeatedly within the subsequent chapters as it relates to: correlations; multilevel models; and Ex-Gaussian decomposition of RTs. Where relevant, further analyses addressing specific predictions in each study are outlined within each of the subsequent chapters. All analyses were conducted in R (version 3.6.1) (R Core Team, 2019).

4.1 Correlations

We apply two kinds of correlation coefficient: Pearson correlation coefficients (*Pearson's r*) for between-subject correlations for foundations measured on the MFCT and MFQ, and a Kendall rank correlation coefficient (*Kendall's* τ) for within-subject correlations between each participants' ordered foundation preferences on the MFCT and MFQ. For each study, we take the mean of these within-subject Kendall rank correlation coefficients as an indicator of how relative foundation preferences measured on the MFCT corresponds to foundation endorsements on the MFQ. Kendall rank correlation coefficients are bootstrapped to assess stability using the *boot* package (version 1.3-24) (Canty & Ripley, 2019). To interpret correlations, we follow Cohen's (1988) suggestions, with r = .10, r = .30, and r = .50 considered to be small, medium , and large, respectively.

4.2 Multilevel models

To predict choice outcomes and RTs, we fit multilevel models to trial-by-trial data from the MFCT. Multilevel models were fit using the *lme* function in the *nlme* package (version 3.1-140) (Pinheiro, Bates, DebRoy, Sarkar, & R Core Team, 2019). To aid interpretation of parameters, all continuous variables are scaled. The distribution of RTs was positively skewed, and RTs were thus log transformed prior to scaling. Ex-Gaussian parameters (discussed below) were also found to be positively skewed and were also log-transformed. Histograms of the distributions of RTs and Ex-Gaussian parameters have been included in the results for each study. Random intercepts are fit for each subject, and where applicable, for either foundation or inter-foundation combination (for RT models), and for action (active or passive) within valence (virtue or vice) blocks. Random intercepts, and their standard deviations, are reported along with fixed effects for each multilevel model. Both marginal R^2 (variance explained by fixed effects) and conditional R^2 (variance explained by fixed and random effects) have been calculated using the *r.squaredGLMM* function in the *MuMIn* package (version 1.43.6) (Bartoń, 2019), and are reported for each model.

4.3 Ex-Gaussian analysis

Following theoretical precedents (Heathcote, Popiel, & Mewhort, 1991; Lacouture & Cousineau, 2008; Luce, 1986; McGill, 1963; Moore et al., 2011), an Ex-Gaussian approach has been applied to estimate parameter values for RT distributions.

The Ex-Gaussian function is a convolution of a Gaussian (normal) and an exponential distribution. The Ex-Gaussian approach therefore acknowledges the positive skew of RT data, by estimating three parameters: (1) μ – the mean, and (2) σ – standard deviation of the Gaussian distribution; and (3) τ – the exponential parameter producing the skewed tail. As a model of cognitive processes, the μ parameter reflects the transduction component, i.e. time required by sensory processes and to physically make responses, while the τ parameter represents the decision component, i.e. time required to decide which response to make (Lacouture & Cousineau, 2008; Luce, 1986). The τ parameter thus relates to increased cognitive demand for conflict resolution (Heathcote et al., 1991; Moore et al., 2008; Steinhauser & Hübner, 2009). Therefore, increased conflict should produce a greater τ estimate. Ex-Gaussian parameters were estimated (with 5,000 iterations) using the maximum likelihood method with the *timefit* function in the *retimes* package (version 0.1-2) (Massidda, 2013).

5 Chapter 5: Measuring intuitive foundation conflict

5.1 Study 1

Though MFT is an intuitionist theory, there is limited evidence for the intuitive processing of moral foundations. Most studies exploring foundation endorsement use an explicit self-report measure – the Moral Foundations Questionnaire (MFQ) (Graham et al., 2011). Moreover, existing studies tend to either focus on the properties of one foundation at a time (e.g. Cannon et al., 2011; Helzer & Pizarro, 2011; Horberg et al., 2009) or are limited to exploring trade-offs of foundations against non-moral goods, i.e. amount of money required for *'kicking a dog hard in the head'* (e.g. Graham et al., 2009). However, real life often requires trade-offs between moral values themselves.

Building on previous foundation trade-off methods (e.g. Study 2, Graham, 2010), this study introduces a Moral Foundation Conflict Task (MFCT) that aims to directly map intuitive foundations through inter-foundation conflicts, and compare these to self-reported foundation endorsement on the MFQ. Furthermore, this study seeks to address existing asymmetries by including foundation virtues and both descriptions of active behaviour and of passive traits.

In this task, participants see pairs of moral violations/vices as active behaviour – 'Cheat to get ahead' versus 'Betray a friend' – or as passive traits – 'Unfair' versus 'Disloyal' – and also as moral virtues, also in active or passive formulations. They are asked to make a fast intuitive dichotomous judgment about which is worse (vice) or better (virtue). The aims of this study are exploratory, and therefore we do not have specific hypotheses. Responses and response times on this task, and how these relate to endorsements on the MFQ are examined.

5.1.1 Method

Participants

A G*power analysis, α = .05 and β = .20, for a one-tailed medium correlation (Pearson's r = .30) identified a target sample size of 67. To allow for some exclusions, we recruited a total of seventy-eight participants through university networks, who were therefore either current students or recent alumni. All participants were required to be fluent English speakers. Three participants were removed due to missing data, leaving a final sample of 75 participants (68% female, M_{age} = 24.09; SD_{age} = 4.48). Participation lasted 15–20 minutes and all participants were paid 3 GBP for their time.

To identify error trials on the conflict task, we reviewed cut-offs employed in previous research. In a similar trade-off task requiring forced choices between moral stimuli, Graham (2010) exclude RTs lower than 150ms and longer than 15 seconds. We theorise that RTs will follow an Ex-Gaussian distribution, and therefore – though the task has been developed to measure fast, intuitive decisions – we applied this long 15 second threshold for maximum RT. However, we felt that given the complexity of the stimuli in the task, the 150ms lower threshold would not effectively capture error trials. Previous work has highlighted the challenges of separating genuine from error RTs (Ratcliff, 1993), and prior work on perception employing two-alternative choice tasks has implemented a variety of methods, e.g. thresholds of 250ms (Ratcliff, Voskuilen, & Teodorescu, 2018) and excluding RTs deviating more than 3 SDs from within-subject means (Janczyk, Nolden, & Jolicoeur, 2015). However, these studies have tended to involve abstract visual stimuli rather than text-based stimuli, and we thus judged these bounds as too lenient. Instead, based on an examination of the distribution of RTs (see Figure 5.1), we selected 400ms as a sensible lower threshold. Trials with response times (RTs) lower than 400ms and longer than 15 seconds were excluded. On this basis, a total of thirteen trials (<.01%) were removed across 8 subjects, leaving a total of 11,987 trials (M_{RT} = 2542ms; SD_{RT} = 1566ms).

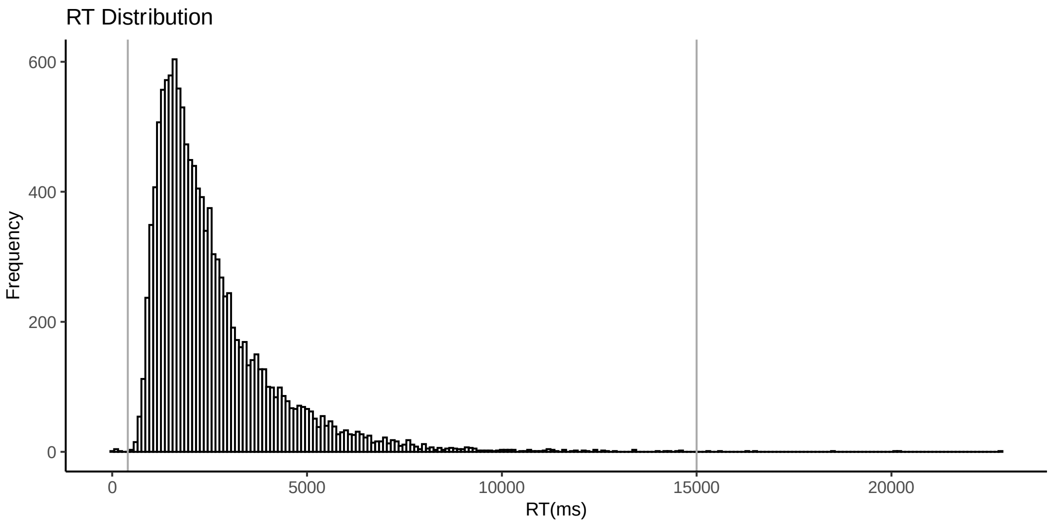

Figure 5.1. Distribution of RTs across all trials in Study 1. Grey reference lines indicate cut-off points of 400ms and 15,000ms.

Measures and Procedure

Participants completed two measures in randomised order.

Moral Foundations Questionnaire (MFQ)

Moral foundations were measured using the 30-item Moral Foundations Questionnaire (MFQ-30) (Graham et al., 2011), assessing concerns for care, fairness, authority, loyalty, and purity using six items each. The MFQ contains two sets of 15 questions. The first item set measures perceived moral relevance of specific pieces of information (e.g. care: 'Whether or not someone suffered emotionally', authority: 'Whether or not someone conformed to the traditions of society'), scaled from 0 (not at all relevant) to 5 (extremely relevant). The second item set measures level of agreement with statements (e.g. fairness: 'Justice is the most important requirement for a society', loyalty: 'I am proud of my country's history'), scaled from 0 (strongly disagree) to 5 (strongly agree). Responses to these two sets of items are combined, and a mean score created for each foundation.

For subscale reliabilities of the MFQ, we report Cronbach's alpha (Cronbach, 1951). Previous work has highlighted that the interpretation of alpha values can be somewhat arbitrary, with a value of .70 often taken as a sufficient threshold for the internal consistency of an instrument (Taber, 2018). Comparing subscale reliabilities to those in Graham et al. (2011) (αs: care = .69; fairness = .65; authority = .74; loyalty =

.71; purity = .84), these were judged to be of similar magnitudes, and thus acceptable, for fairness (α = .55), authority (α = .63), loyalty (α = .71), and purity (α = .79), but was notably lower for care (α = .38). Generally, lower internal consistency is not uncommon with the MFQ, and building on previous scale development work (Gough, 1979, 1984; John & Soto, 2007), Graham et al. (2011) argue that the MFQ strikes a balance between sufficient internal consistency, and comprehensive coverage of the various facets of a foundation.

Moral Foundations Conflict Task (MFCT)

This task was completed on a computer and required speeded dichotomous choices between foundation-related words and phrases. The task is split into four blocks: (1) Virtue Active – items describing active virtue behaviour; (2) Virtue Passive – items describing passive virtue traits; (3) Vice Active - active vice behaviour; and (4) Vice Passive – passive vice traits. Table 5.1 provides examples of items in each block.

Table 5.1. Example items for MFCT

Block	*Prompt*	*Sample Item*
Virtue Active	It is better to	Treat everyone equally (*Fairness*)
Virtue Passive	It is better to be	Respectful (*Authority*)
Vice Active	It is worse to	Do something disgusting (*Purity*)
Vice Passive	It is worse to be	Cruel (*Care*)

Note. For each sample item, the corresponding foundation is provided in parentheses.

Items were adapted from the Moral Foundations Dictionary (Graham et al., 2009). The MFCT includes 160 pairings of items, comprising four closely matched items in each block on valence score, the average of independent coders ratings, *ICC* = .69, *95% CI* [.58, .77], and length (number of letters) for each inter-foundation combination (see Chapter 3 for more information on development, see Appendix 1 for full list of items and pairings).

Participants were randomly assigned to start with either both positive or both negative blocks, and within these, with either active or passive items. Instructions were given at the start of positive and negative blocks and asked participants to make choices as quickly as they could, based on their gut response.

Participants were presented with a total of 14 practice trials (7 virtue and 7 vice) and 160 test trials, with 16 trials for each of the ten inter-foundation combinations, with 4 pairings per combination in each of the four blocks. Items were randomly reversed to appear on the left or right.

A response, i.e. which item is chosen, and RT, i.e. time (in ms) to make a choice, are recorded for each trial. To analyse responses, a score was created for each foundation based on the number of times it was chosen out of the number of times it appeared in any combination, ranging from 0 (never chosen) to 1 (always chosen). To analyse RT, we employ Ex-Gaussian estimation alongside analyses of mean RT.

5.1.2 Results

Results are broadly separated into three main sections. Firstly, we assess the effects of the structure of the MFCT, specifically looking at whether the valence score and length of item pairings differ across foundation, and if there are any differences in response or RT patterns across blocks on the MFCT. We then explore correlations between responses on the MFCT and scores on the MFQ. Finally, we look at RTs on the MFCT as indicators of conflict in decisions between foundations, and exploring ways of capturing differences in the relative value of foundations in choices on the MFCT.

Examining properties of the MFCT, we found that items that had higher ratings of positivity (for virtues) or negativity (vices), or that were longer in length, were more likely to be chosen. We also found some differences in RTs across the four item blocks on the MFCT. In particular, RT and τ is lower for virtue and passive items. Comparing responses patterns on the MFQ and MFCT, we found that these correlated at $r_\tau(75) = .50$, indicating a large, though imperfect, match between the two. This correlation is stable across the blocks of the task. In RT analyses, we generally found that RTs – and, where relevant, τ – decreased for foundations further apart in value, consistent with our expectations that this corresponds with making easier and less conflicting decisions. However, effects in these models are small.

Structure of MFCT

Valence score and length of items

Though item pairings were created to be as closely matched for valence score (average valence rating given by independent coders in item development), and for length (number of letters), slight differences in these properties may impact whether an item is chosen in a given pairing. To explore this, we fit a logistic model predicting whether or not an item was chosen based on valence score and length (Table 5.2). Items with higher valence scores and longer in length are more likely to be chosen. This may be partially accounted for by differences in valence scores and item length across foundation.

Table 5.2. Choice by valence score and length for Study 1

	Model	
	β	OR
Fixed effects		
Intercept	.01 (.13)	1.01
Valence Score	1.28*** (.03)	3.58
Length	.24*** (.04)	1.28
Valence Score : Length	.25*** (.03)	1.28
Random effects - σ		
Subject	< .001	
Item Pair	1.04	
Valence	.04	
Action	.14	
Marginal R^2 / Conditional R^2	.24 / .41	
LogLik	-15,550	
AIC	31,116	
BIC	31,181	

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 23,974. OR – Odds ratios. Fixed and random effects for logistic model predicting choice. Predictors have been standardised. For fixed effects, *SE* is provided in parentheses. Pseudo R^2 calculated using the delta method (Nakagawa, Johnson, & Schielzeth, 2017).

Valence scores were higher for individualising foundations (care and fairness) than for binding foundations (authority, loyalty and purity), and this is reflected in separate models predicting valence score for choices (Table 5.3). For both the chosen, $\beta = -1.83$, $p < .001$, and not chosen items, $\beta = -1.75$, $p < .001$, binding foundations had lower valence scores than individualising foundations, and were also shorter in length for both chosen, $\beta = -.12$, $p < .001$, and not chosen items, $\beta = -.27$, $p < .001$.

Table 5.3. Valence score and length of items by foundation for Study 1

	Models			
	Valence Score		Length	
	Chosen	Not Chosen	Chosen	Not Chosen
Fixed effects				
Intercept	-.17*** (.01)	.16*** (.01)	-.01 (.01)	.03** (.01)
Foundation				
Binding v. Individualising	-1.83*** (.01)	-1.75*** (.02)	-.12*** (.02)	-.27*** (.02)
Fairness v. Care	.08*** (.01)	.04** (.01)	.01 (.01)	-.13*** (.02)
Loyalty v. Authority	.35*** (.01)	.33*** (.01)	.06** (.02)	-.08*** (.02)
Purity v. Authority	-.17*** (.01)	-.01 (.01)	-.04* (.02)	-.18*** (.01)
Random effects				
By Subject - σ				
Intercept	< .001	< .001	< .001	< .001
Item Pair	.25	.56	.67	.48
Valence	.32	.30	.49	.56
Action	.50	.30	.55	.64
Residual	.03	.03	.05	.04
Marginal R^2/ Conditional R^2	.59 / .99	.50 / .99	.003 / .99	.04 / .99
LogLik	-11,683	-12,869	-16,989	-16,762
AIC	23,387	25,759	33,998	33,544
BIC	23,461	25,833	34,072	33,618

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 11,987. Fixed and random effects for separate models predicting valence score and length of chosen and not chosen items in a given trial. Outcome variables have been standardised. Individualising, care and authority are reference levels. For fixed effects, *SE* is provided in parentheses.

To explore whether RT might be predicted by valence score and item length, the difference between these for the items in a given trial was used (Table 5.4). The difference in valence score did have an effect on RT, $\beta = -.11$, $p < .001$, with quicker choices as the difference in valence score between items in a trial increased. There was also an effect for the difference in the length of items on RT, $\beta = .08$, $p < .001$, with slower choices between items with a larger difference in length.

Table 5.4. RT by difference in valence score and length for Study 1

	Models	
	log RT	
Fixed effects		
Intercept	.001 (.06)	.001 (.06)
Difference in Valence Score	$-.11^{***}$ (.01)	
Difference in Length		$.08^{***}$ (.01)
Random effects		
By Subject - σ		
Intercept	.55	.55
Item Pair	.47	.47
Valence	.47	.47
Action	.47	.47
Residual	.18	.18
Marginal R^2 / Conditional R^2	.01 / .97	.01 / .97
LogLik	-14,888	-14,943
AIC	29,791	29,899
BIC	29,842	29,951

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 11,987. Fixed and random effects for separate models predicting standardised log RT from standardised absolute differences in valence score and length between items in a given trial. For fixed effects, *SE* is provided in parentheses.

Based on models exploring valence scores, items that are more positive (virtues) or negative (vices) are more likely to be chosen as better (virtues) or worse (vices), with slower choices when the two items in a trial are more closely matched on valence score. Items longer in length were also more likely to be chosen, with a greater difference in length between two items in a trial predicting longer RTs. These effects are likely impacted by differences across foundations, with items for individualising foundations tending to be rated as are more positive/negative, and slightly longer in length, than items for binding foundations. However, models attempting to include a random intercept for item pairings to account for these effects tended to fail to converge and we have thus omitted this from subsequent analyses.

Effect of blocks

Analyses assessed whether blocks on the MFCT had any effect on responses and RT patterns, to explore whether it may be appropriate to collapse further analyses across blocks. Table 5.5 shows separate models predicting scores and RT on the MFCT from block valence (virtue or vice), block action (active or passive), and foundation.

Neither the valence, nor the action formulation of items, nor the interaction between valence and action had an effect on MFCT scores. However, the interaction between valence and action did affect RT, β = -.27, p = < .001, with passive items being faster in the virtue block.

There was a significant effect of foundation on MFCT scores, with binding foundations chosen less than individualising foundations, β = -.75, p < .001. This is reflected in RTs, with binding foundations chosen slower than individualising foundations, β = .23, p < .001. This pattern likely reflects the fact that most student participants were likely liberal, hence prioritising individualising foundations, and taking less time to choose them. Significant interactions between valence, action, and foundation can be seen in Table 5.5, Figure 5.2 and Figure 5.3.

Table 5.5. MFCT score and RT by blocks and foundation for Study 1

	Models	
	MFCT Score	log RT
Fixed effects		
Intercept	-.002 (.04)	.27*** (.07)
Valence (Virtue v. Vice)	.001 (.06)	-.02 (.02)
Action (Passive v. Active)	-.001 (.06)	-.35*** (.02)
Foundation		
Binding v. Individualising	-.75*** (.10)	.23*** (.04)
Fairness v. Care	-.56*** (.06)	.12*** (.02)
Loyalty v. Authority	.36*** (.07)	-.06* (.03)
Purity v. Authority	-.20** (.07)	.08** (.03)
Valence : Action	.0002 (.08)	-.27*** (.03)
Valence : Foundation		
Valence : Binding v. Individualising	-.58*** (.14)	-.11* (.05)
Valence : Fairness v. Care	.74*** (.09)	-.13*** (.03)
Valence : Loyalty v. Authority	.02 (.10)	-.02 (.04)

Valence : Purity v. Authority	.58*** (.10)	-.09* (.04)
Action : Foundation		
Action : Binding v. Individualising	-.63*** (.14)	-.003 (.05)
Action : Fairness v. Care	.07 (.09)	-.01 (.03)
Action : Loyalty v. Authority	.04 (.10)	.08* (.04)
Action : Purity v. Authority	.06 (.10)	-.22*** (.04)
Valence : Action : Foundation		
Valence : Action : Binding v. Individualising	.85*** (.20)	-.06 (.07)
Valence : Action : Fairness v. Care	-.52*** (.13)	.08† (.04)
Valence : Action : Loyalty v. Authority	-.72*** (.15)	.02 (.06)
Valence : Action : Purity v. Authority	-.76*** (.15)	.18** (.06)
Random effects		
By Subject - σ		
Intercept	< .001	.55
Residual	.78	.79
Marginal R^2 / Conditional R^2	.39 / .39	.08 / .38
LogLik	-1,757	-14,294
AIC	3,557	28,632
BIC	3,674	28,794

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 1,500 (MFCT Score) and 11,987 (log RT). Fixed and random effects for separate models predicting MFCT score and log RT. Outcome variables have been standardised. For RT model, foundation represents the foundation of the item chosen in a given trial. Planned contrasts for foundation compare individualising to binding foundations (with the former as the reference level), and then compare Care to Fairness (former as reference level), and Authority to Loyalty and Purity (Authority as reference level). For valence and action, vice and active are reference levels. For fixed effects, *SE* is provided in parentheses.

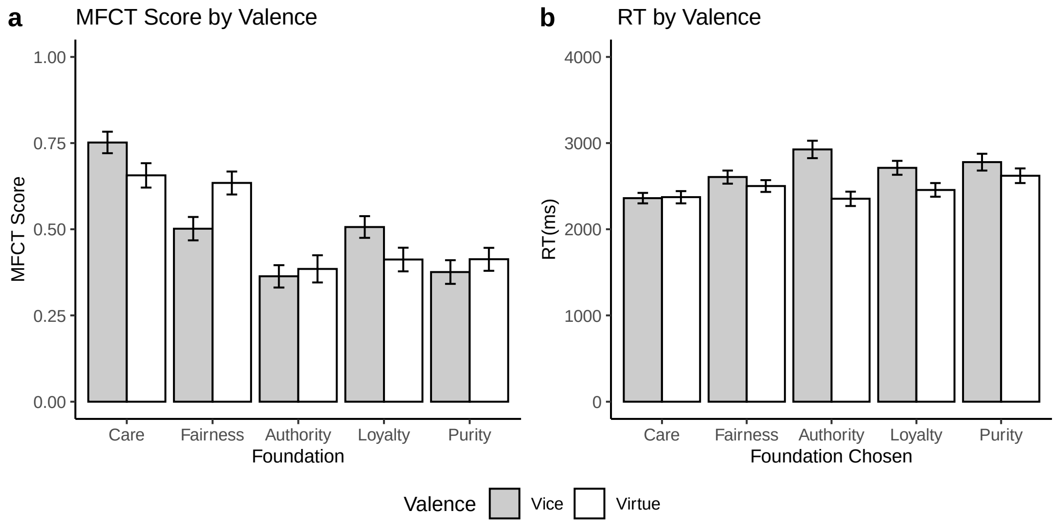

Figure 5.2. MFCT score (a) and RT (b) by valence block and foundation in Study 1. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

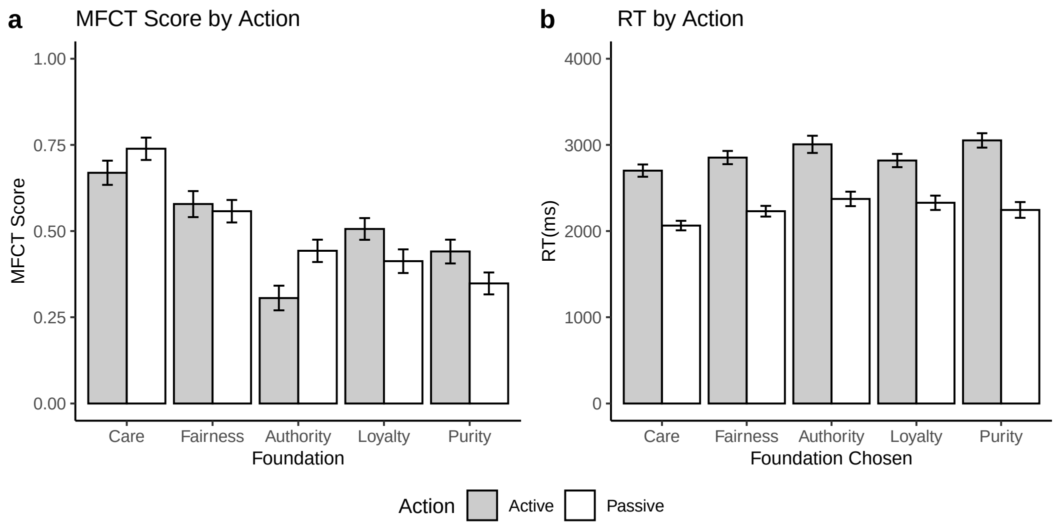

Figure 5.3. MFCT score (a) and RT (b) by action block and foundation in for Study 1. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

To explore whether block effects on RT might be informed by Ex-Gaussian analyses, within-subject mean RTs and Ex-Gaussian parameters were fit for each block (see Table 5.6 and Figure 5.4). Differences in μ and τ across blocks indicate differences in processing speed for different formulations of items, and differences in conflict in choices, respectively. The interaction between valence and action again predicted mean RT, β = -.38, p < .001, and μ, β = -.58, p < .001, indicating faster processing speed for passive virtue items. τ is smaller for virtue, β = -.26, p < .05, and passive items, β = -.31,

$p < .05$, indicating lower conflict in these blocks. The effect of both valence and action is expressed in both μ and τ, indicating that vice and active items entail longer processing time – expected for active items as they are longer, more complex items – and greater conflict. In contrast to mean RT and μ, there was no evidence of an interaction between valence and action for τ. These patterns for μ and τ demonstrate the strengths of an Ex-Gaussian approach in revealing more information about RT distributions than mean RT alone.

These analyses indicate that the block structure of the task does impact response patterns and RTs on the MFCT differentially across foundations. For RT, it seems to be quicker and easier to make choices between virtue and passive items. Subsequent analyses include random intercepts for valence and action.

Table 5.6. RT, μ and τ by blocks for Study 1

	Models		
	log RT	log μ	log τ
Fixed effects			
Intercept	$.36^{**}$ (.11)	$.20^{\dagger}$ (.11)	$.23^{*}$ (.11)
Valence (Virtue v. Vice)	-.03 (.06)	$.23^{*}$ (.11)	$-.26^{*}$ (.12)
Action (Passive v. Active)	$-.50^{***}$ (.06)	$-.33^{**}$ (.11)	$-.31^{*}$ (.12)
Valence : Action	$-.38^{***}$ (.08)	$-.58^{***}$ (.16)	.20 (.17)
Random effects			
By Subject - σ			
Intercept	.85	.63	.67
Residual	.36	.69	.72
Marginal R^2 / Conditional R^2	.14 / .87	.12 / .52	.05 / .34
LogLik	-238	-369	-385
AIC	489	751	781
BIC	511	773	803

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 300. Fixed and random effects for separate models predicting log RT, μ and τ. Outcome variables have been standardised. For valence and action, vice and active are reference levels. For fixed effects, *SE* is provided in parentheses.

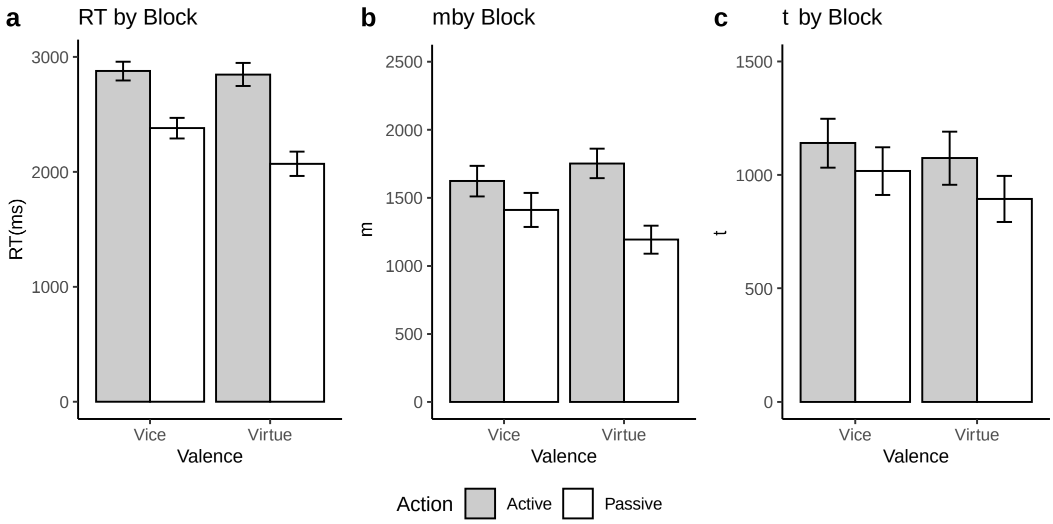

Figure 5.4. Mean RT (a), μ *(b)* and τ (c) by blocks. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

To assess the internal reliability of the full MFCT, as well as across blocks, the task was randomly split into two halves, scores were calculated for each half, and a split-half correlation was calculated for each participant. Split-half correlations were then adjusted using the Spearman-Brown formula to get an estimate of the reliability of the full MFCT (Eisinga, Grotenhuis, & Pelzer, 2013; Kaplan & Saccuzzo, 2001). This process was then repeated, with bootstrap resampling with random splits. Table 5.7 shows split-half reliability coefficients. Reliability for the full task, and across blocks in the task, is acceptable, but slightly lower for the active blocks, likely reflecting more complex items in these blocks.

Table 5.7. Bootstrapped split-half reliability across blocks for Study 1

	r_{Boot}	Bias	95% CI of *r*	*SE* r_{Boot}
Study 1 (*N* = 75)				
Full Task	.85	.002	[.81, .89]	.02
Vice	.83	.01	[.77, .87]	.02
Virtue	.79	-.02	[.73, .89]	.04
Active	.69	.05	[.58, .70]	.03
Passive	.80	-.002	[.74, .87]	.03

Note. Bootstrapped with 5,000 iterations.

Correlating MFQ and MFCT

Mean responses on the MFQ and the MFCT are shown in Table 5.8, along with correlations, corrected for multiple comparisons, between foundations measured on the MFQ and on the MFCT. The correlations for care, $r = .47$, $p <. 001$, loyalty, $r = .55$, $p < .001$, and purity, $r = .53$, $p < .001$ are significant, with marginal significance for authority, $r = .30$, $p < .10$, however this was not the case for fairness, $r = .20$.

To compare patterns of foundation endorsement on the MFCT to MFQ responses, a Kendall rank correlation coefficient was calculated for each participant. These coefficients ranged from -.89 to 1.00, with a mean of r_τ (75) = .50. Bootstrap resampling gave an estimate of $r_{\tau Boot}$ = .51 (*SE* $r_{\tau Boot}$ = .05, *95% CI* [.43, .61].

Table 5.8. Descriptive statistics and Pearson correlations for Study 1 variables

	M	*SD*	1	2	3	4	5	6	7	8	9
1. Care-MFQ	3.88	.49									
2. Fairness-MFQ	3.91	.53	.25								
3. Authority-MFQ	2.35	.76	-.09	-.06							
4. Loyalty-MFQ	2.50	.83	-.01	-.02	.54***						
5. Purity-MFQ	1.97	.98	.01	.00	.49***	.38**					
6. Care-MFCT	.70	.13	**.47*** **	.14	-.33*	-.42**	-.30†				
7. Fairness-MFCT	.57	.13	-.06	**.20**	-.28	-.45***	-.41**	.18			
8. Authority-MFCT	.37	.11	-.23	.00	**.30†**	.26	.17	-.53***	-.31†		
9. Loyalty-MFCT	.46	.13	.01	-.13	.17	**.55*** **	.04	-.35*	-.39**	-.10	
10. Purity-MFCT	.39	.13	-.22	-.21	.19	.09	**.53*** **	-.38**	-.52***	.11	-.20

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. MFQ scores are on a 0 to 5 scale, MFCT scores are on a 0 to 1 scale. *p*-values corrected for multiple comparisons (Bonferroni). Correlations between the same foundations on the MFQ and on the MFCT have been highlighted in bold.

A mean correlation coefficient was calculated for each block to explore whether this correlation is maintained across blocks (see Table 5.9). To compare correlations, an approach proposed by Zou (2008) and Baguley (2012) was used, using upper and lower bounds of the CIs for correlations to calculate a CI for their difference, adjusted to account for a shared predictor. Here, CIs approaching -1 or 1 indicate increasing asymmetry, while CIs that include 0 indicate a non-significant difference between correlations. Based on this, there is no evidence for differences in correlations between the MFQ and MFCT for vices and virtues, *95% CI* [-.27, .02], nor for active and passive blocks, *95% CI* [-.31, .01].

Table 5.9. Correlations between MFQ and MFCT scores across blocks for Study 1

	Sample r_τ	$r_{\tau Boot}$	Bias	95% CI of r_τ	*SE* $r_{\tau Boot}$	95% CI of Difference
Study 1 (*N* = 75)						
Full Task	.50	.51	-.016	[.43, .61]	.049	
Vice	.43	.45	-.027	[.39, .56]	.046	[-.27, .02]
Virtue	.53	.57	-.042	[.54, .67]	.038	
Active	.38	.42	-.041	[.37, .55]	.047	[-.31, .01]
Passive	.49	.53	-.035	[.47, .64]	.046	

Note. Bootstrapped with 5,000 iterations. CIs are the Bias Corrected Accelerated (BCa) intervals

These results indicate a 50% match between the order, or ranks, of foundation endorsement measured by the MFQ and foundation preference expressed in the MFCT, stable across all blocks of the task.

Predicting RT on the MFCT

A key feature of the MFCT as a speeded forced choice task is that it measures response time as an additional metric of foundation endorsement. We expect that, if there is a smaller difference in how valued two foundations are, then it is more difficult to choose between them, and the decision should take longer. Therefore, we explore whether RT on the MFCT can be interpreted as an indicator of conflict in decisions between foundations. We expect conflict to vary based on how valued two foundations are, as measured by endorsement on the MFQ, and by overall preferences on the MFCT as an indicator of consistency in the task. The following analyses are exploratory in nature, and operationalise difference in value between foundations in a number of ways, with limitations discussed.

Difference in foundation scores predicting RT

First, we modelled the difference in value between foundations as the difference in scores between the foundation chosen in a given trial, and the foundation not chosen. Separate multilevel models (see Table 5.10) were fit to predict RT from the difference between MFQ and MFCT scores. We expected that RT would be highest when the difference is 0 indicating that two foundations are equally valued. In addition, we anticipated that this relationship would be non-linear, and could be represented by the quadratic equation $y = x - x^2$, taking the form of a upside-down parabola with a vertex (highest point) when x equals 0. To implement this in our models, we fit both a linear (x) and quadratic term (x_2) for the difference in scores. Figure 5.5 shows a plot of predicted values from the resulting quadratic regressions.

For MFQ scores, the linear term was significant, β = -.09, p < .01, in the expected direction, with RT decreasing as the difference in MFQ scores increases. However, the quadratic term was not significant, β = .01, p > .10. Conversely, for MFCT scores, the linear term was not significant, β = -.02, p > .10, though the quadratic term was significant in the predicted direction, β = -.02, p < .05. This suggests that the relationship between RT and difference in scores is linear for MFQ scores, and quadratic for MFCT scores. However, in both cases these effects are small.

Table 5.10. Predicting RT from difference in MFQ and MFCT scores for Study 1

	Models	
	log RT	
Fixed effects		
Intercept	.10 (.07)	.10 (.07)
Difference in MFQ Scores	-.09** (.03)	
Difference in MFQ Scores^2	.01 (.01)	
Difference in MFCT Scores		-.02 (.03)
Difference in MFCT Scores^2		-.02* (.01)
Random effects		
By Subject - σ		
Intercept	.55	.55
Foundation Combination	< .001	< .001
Valence	< .001	< .001
Action	.37	.36
Residual	.75	.75
Marginal R^2 / Conditional R^2	.004 / .44	.01 / .44
LogLik	-14,698	-14,670
AIC	29,413	29,356
BIC	29,472	29,415

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 11,987. Fixed and random effects for separate models predicting log RT. Outcome variables have been standardised. Quadratic models fit terms for difference in scores (x) and squared difference in scores (x^2) between foundations in a trial. In order to preserve a minimum value of 0 interpretable as no difference between scores for the quadratic term, difference predictors in these models were scaled by SD without centring. For fixed effects, *SE* is provided in parentheses. Models that included a random intercept for item pairings failed to converge and this term was thus excluded.

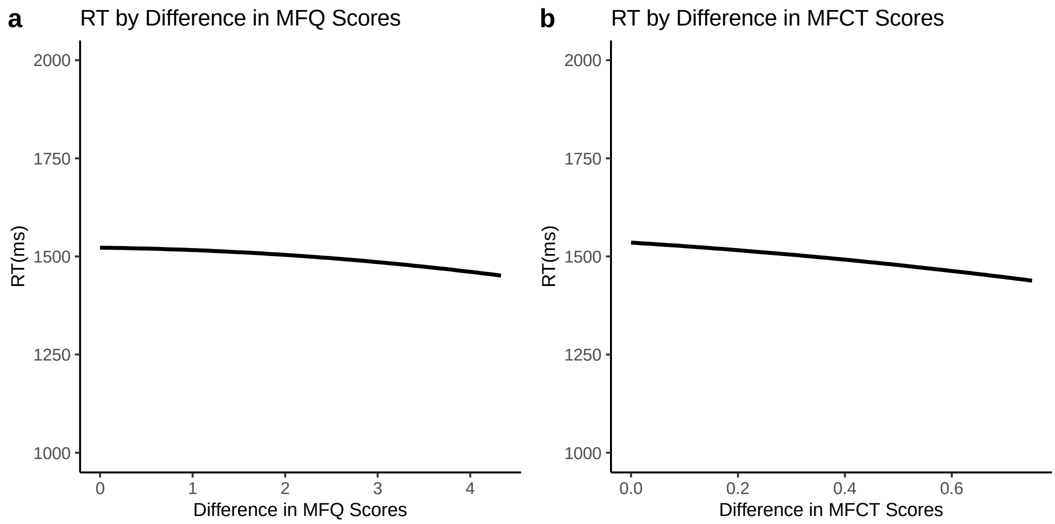

Figure 5.5. Predicting RT for Study 1 with quadratic models for (a) difference in MFQ scores and (b) difference in MFCT scores between foundations in a trial. Grey areas represent 95% CI boundaries.

Ranks apart predicting RT

To probe RT as an indicator of conflict in decisions between foundations, we apply Ex-Gaussian decomposition of RT distributions from the MFCT, i.e. how many ranks apart foundations in each trial are based on each participant's rank ordering, or order of foundations endorsement/preference. Ranks were produced by ordering foundations from most valued (1st rank) to least valued (5th rank), based either on MFQ or MFCT scores. When foundations had equal scores, these were given the same rank. A total of 32 participants had equally scored foundations on the MFQ, and 19 had these on the MFCT. When participants had equally scored foundations, subsequent ranks were labelled sequentially, e.g. if a participant had two foundations ranked as 2nd, the next highest scoring foundation was labelled as 3rd.

We predict that it will take longer and be more difficult to choose between foundations fewer ranks apart, and therefore more closely matched in value. It is expected that fewer ranks apart will result in greater overall RT and τ, as a measure of decision conflict, but not necessarily be reflected in μ, a measure of time to physically make responses (Heathcote et al., 1991; Luce, 1986). Figure 5.6 and Figure 5.7 show histograms for within-subject mean RTs, μ and τ calculated for ranks apart categories based on the MFQ and MFCT, respectively.

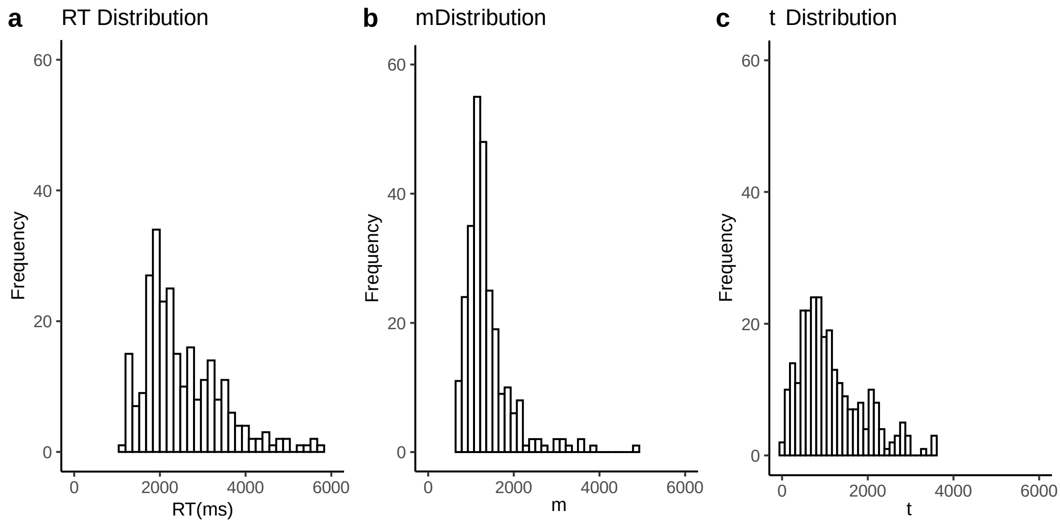

Figure 5.6. Distribution of RT (a), μ (b) and τ (c) across MFQ rank apart categories in Study 1

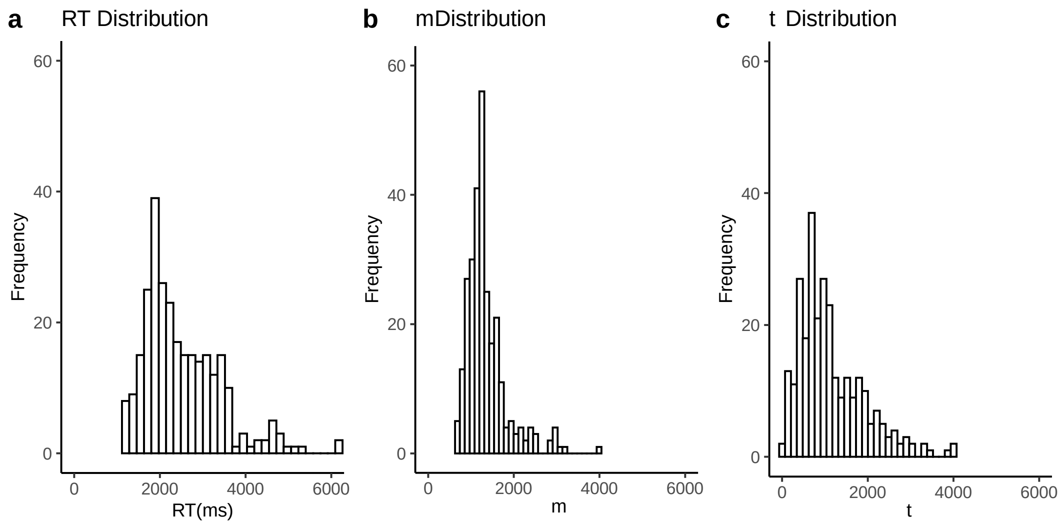

Figure 5.7. Distribution of RT (a), μ (b) and τ (c) across MFCT rank apart categories in Study 1

Multilevel models were fit to predict RT, μ and τ from ranks apart based on the MFQ and the MFCT, with a set of planned contrasts (Helmert coding), testing whether the former increases with fewer ranks apart (see Table 5.11). Helmert coding compares each level of a categorical variable to the mean of the subsequent levels (UCLA: Statistical Consulting Group, 2019). Due to substantial error for equally valued choices (0 ranks apart) due to infrequent occurrence, models were fit with this rank category dropped.

Ranks apart on MFQ

For choices between closely valued foundations, based on rank order on the MFQ, we would expect longer RTs and greater τ, but not necessarily greater μ. This would manifest in decreasing RT and τ, as the number of ranks apart increased, a trend that can be seen weakly in Figure 5.8 (panels a and c).

Mean RT was higher in choices between foundations one rank apart on the MFQ, relative to subsequent ranks apart, β = .10, p < .01, but there were no evident differences in RT for other comparisons, βs < |.05|, ps > .10. There was also higher τ in two rank apart choices, β = .26, p < .01, relative to further apart choices, with no evident differences in τ for other comparisons, βs < |.09|, ps > .10. None of the planned contrast were significant for μ, all βs < |.16|, ps > .10.

Ranks apart on MFCT

The expected decreasing trend in RT and τ is clearer for ranks apart based on the task itself (see Figure 5.9, panels a and c). Mean RT decreased with ranks apart in the predicted direction, all βs > .14, ps < .05, as did τ for one rank apart choices, β = .25, p < .01, and marginally for two rank apart choices, β = .16, p < .10, relative to further apart choices. There was an effect for μ for three rank apart choices relative to four rank apart choices, β = .30, p < .05, but no other contrasts were significant for μ, βs < .15, ps > .10.

Table 5.11. Predicting RT, μ and τ from ranks apart on the MFQ and MFCT for Study 1

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	.02 (.11)	.003 (.09)	.01 (.10)	-.03 (.11)	-.03 (.09)	-.001 (.10)
Ranks Apart						
1 RA v. 2, 3, 4	.10** (.04)	.11 (.10)	.07 (.09)	.21*** (.04)	.15 (.10)	.25** (.08)
2 RA v. 3, 4	.04 (.04)	-.16 (.11)	.26** (.10)	.15*** (.04)	.09 (.11)	.16† (.09)
3 RA v. 4	-.05 (.05)	-.02 (.14)	-.09 (.12)	.14* (.05)	.30* (.13)	-.13 (.11)
Random effects						
By Subject - σ						
Intercept	.94	.71	.76	.94	.69	.77
Residual	.26	.69	.62	.29	.72	.60
Marg. R^2 / Cond. R^2	.003 / .93	.01 / .52	.01 / .61	.01 / .92	.01 / .49	.02 / .64
LogLik	-159	-335	-317	-187	-360	-327
AIC	330	683	646	386	731	665
BIC	352	704	668	408	753	687

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 265 (MFQ) and 280 (MFCT). RA – Ranks Apart. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. Helmert coding compares each rank apart category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

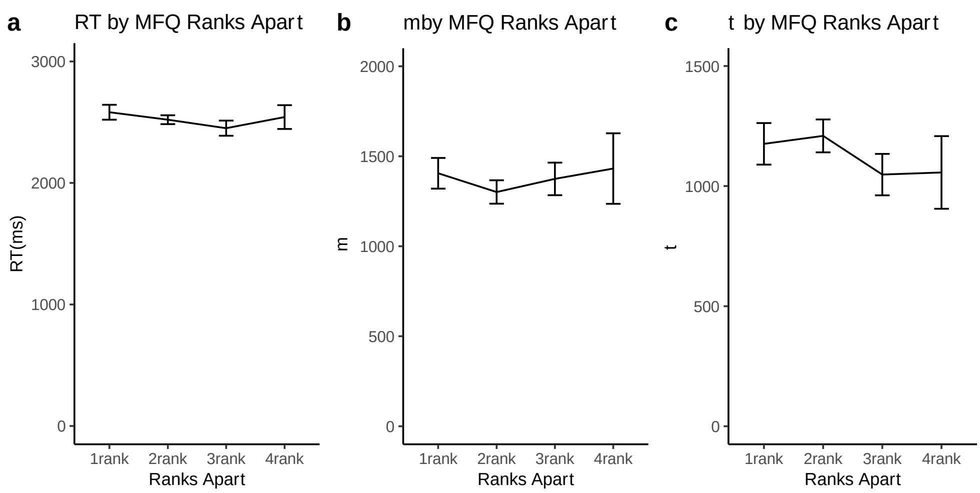

Figure 5.8. Ranks apart on MFQ predicting RT (a), μ (b) and τ (c) for Study 1. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

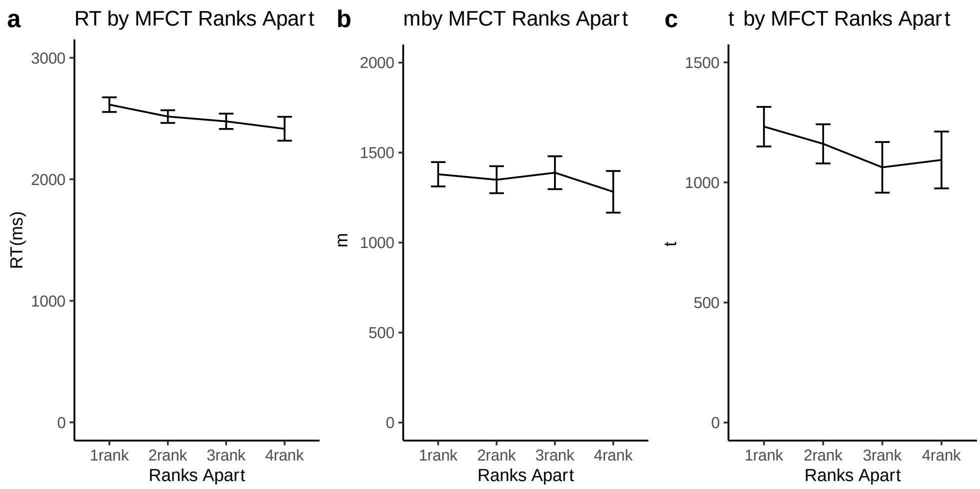

Figure 5.9. Ranks apart on MFCT predicting RT (a), μ (b) and τ (c) for Study 1. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

These analyses suggest that foundations endorsement/preference is reflected in RTs on the MFCT, and that this tracks expected conflict in decisions between more closely valued foundations. However, these patterns are noisy.

Contributing to this noise, the above ways of operationalising the difference in value between foundations do not account for *how much* value is placed on each foundation, i.e. a choice between a participant's first and second most valued foundation may generate the same difference, or the same number of ranks apart, as a choice between the fourth and fifth. To address this, we ran a number of analyses attempting to capture these differences in value.

Weighted difference scores predicting RT

We expect that RT on a choice between foundations on the MFCT will not only be predicted by how closely valued the two foundations are, but will also vary based on how much they are valued. However, we do not have clear predictions about the directions. Decisions between less valued foundations may incur lower conflict, and therefore shorter RTs. Conversely, these decisions may incur longer RTs, resulting from reduced certainty in choosing between less valued foundations.

To explore this, a difference score was created for each inter-foundation combination to weight the difference between foundation scores by the mean score of the two foundations in a choice (calculated as $mean(Score_1, Score_2) * (1 - abs(Score_1 -$

Score$_2$)). MFQ scores were transformed into values ranging 0 to 1, to match MFCT scores, before being entered into this formula. Difference scores based on the MFQ and on the MFCT correlated at $r = .58$, $p < .001$, *95% CI* [.53, .63].

Separate multilevel models (see Table 5.12) were fit to predict RT for each trial from difference scores based on MFQ and MFCT scores. There were no effects for MFQ difference scores, $\beta = -.004$, $p > .10$, nor for MFCT difference scores, $\beta = .01$, $p > .10$, which may indicate that the weighted difference score calculated for each inter-foundation combination does not adequately capture differences in value.

Table 5.12. Predicting RT from difference score based on MFQ and MFCT

	Models	
	log RT	
Fixed effects		
Intercept	.001 (.06)	.001 (.06)
Difference Score MFQ	-.004 (.01)	
Difference Score MFCT		.01 (.01)
Random effects		
By Subject - σ		
Intercept	.55	.55
Foundation Combination	< .001	< .001
Valence	< .001	< .001
Action	.37	.37
Residual	.75	.75
Marginal R^2 / Conditional R^2	< .001 / .44	< .001 / .44
LogLik	-14,713	-14,713
AIC	29,441	29,439
BIC	29,493	29,491

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 11,987. Fixed and random effects for separate models predicting log RT. Outcome variables have been standardised. Difference score calculated as *mean*($Score_1$, $Score_2$) * (1 - *abs*($Score_1$ - $Score_2$)). For fixed effects, *SE* is provided in parentheses.

A further set of models were fit, collapsing RT and fitting within-subject Ex-Gaussian parameters to RT distributions for each inter-foundation combination (see Table 5.13). Here, higher difference score based on MFCT scores did predict RT with a small effect, $\beta = .04$, $p < .05$, but all other effects were not significant, βs = |.06|, $p > .10$.

Table 5.13. Predicting RT, μ and τ from difference score based on MFQ and MFCT

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	.00 (.10)	.00 (.08)	-.00 (.08)	.00 (.10)	.00 (.08)	-.00 (.08)
Difference Score MFQ	-.01 (.02)	-.06 (.04)	.02 (.03)			
Difference Score MFCT				.04* (.02)	< .001 (.03)	.01 (.03)
Random effects						
By Subject - σ						
Intercept	.90	.62	.68	.89	.63	.68
Foundation Combination	.40	.71	.67	.39	.72	.67
Residual	.20	.30	.29	.20	.30	.29
Marginal R^2 / Conditional R^2	< .001 / .96	.003 / .91	.001 / .92	.002 / .96	< .001 / .91	< .001 / .92
LogLik	-597	-950	-916	-594	-951	-916
AIC	1,203	1,910	1,841	1,198	1,913	1,841
BIC	1,227	1,933	1,864	1,221	1,936	1,865

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 750. Fixed and random effects for separate models predicting log RT, μ and τ, estimated for each foundation combination. Outcome variables have been standardised. Difference score calculated as $mean(Score_1, Score_2) * (1 - abs(Score_1 - Score_2))$. For fixed effects, *SE* is provided in parentheses.

Weighted ranks apart predicting RT

We fit models with an alternative way of capturing differences in value based on participants' rank ordering of foundations. These models included a bias term for the ranks in a choice, calculated as $mean(Rank_1, Rank_2)$, to weight the number of ranks apart foundations are in each trial. To create the bias term, ranks were reversed, so that the most valued foundation ranks as 5, and the least valued ranks as 1, such that a higher mean rank for foundations in a choice indicates higher value.

Models (see Table 5.14) tested effects for the bias term for the mean rank of foundations in a given trial, their ranks apart, and the interaction between these. For ranks based on both MFQ and MFCT scores, RT is negatively predicted by mean rank, βs = -.06, *p*s < .001, and by number of ranks apart, βs < -.03, *p*s < .01, indicating that as the value, and the difference in value, of foundations in a choice increases, time to make the choice decreases. However, there was no evidence of an interaction between these for ranks based on either MFQ or MFCT scores, βs < |.01|, ps > .10.

Table 5.14. Predicting RT from mean rank and ranks apart on the MFQ and MFCT for Study 1

	Models	
	log RT	
	MFQ	MFCT
Fixed effects		
Intercept	-.0005 (.06)	.001 (.06)
Mean Rank	$-.06^{***}$ (.01)	$-.06^{***}$ (.01)
Ranks Apart	$-.03^{**}$ (.01)	$-.06^{***}$ (.01)
Mean Rank : Ranks Apart	-.01 (.01)	-.005 (.01)
Random effects		
By Subject - σ		
Intercept	.55	.55
Foundation Combination	< .001	< .001
Valence	< .001	< .001
Action	.37	.36
Residual	.75	.75
Marginal R^2 / Conditional R^2	.003 / .44	.006 / .44
LogLik	-14,697	-14,680
AIC	29,412	29,379
BIC	29,479	29,445

Note. † p < .10, * p < .05, ** p < .01, *** p < .001. Number of observations = 11,987. Fixed and random effects for separate models predicting log RT. Outcome variables and predictors have been standardised. Mean rank calculated as *mean*($Rank_1$, $Rank_2$), of reversed ranks, such that higher mean rank indicates more valued foundations. For fixed effects, *SE* is provided in parentheses.

Ranks apart split by rank chosen predicting RT

To further explore effects on RT at different levels of value, we replicated ranks apart analyses on RT distributions split by the rank of the foundation that was chosen in each trial. Multilevel models were fit to predict RT, μ and τ for each rank, based on the MFQ and the MFCT, that was chosen (1st rank to 5th rank) from the rank not chosen (also 1st rank to 5th rank) in a given trial. As in previous analyses, the small number of equally ranked choices were dropped, and a set of planned contrasts compare each rank category to the mean of the subsequent rank categories.

Ranks apart split by split by rank chosen on MFQ

Figure 5.10 shows plots for RT, μ and τ for each rank chosen, based on MFQ scores. For mean RT, there were no significant effects, βs < |.10|, *p*s > .10 (see Table 5.15 – Table 5.19), with the exception of a marginal effect for 2nd rank choices when the 1st rank was not chosen, β = .11, *p* < .10 (see Table 5.15).

When highest ranked (1st rank) foundations were chosen, μ was higher for 2nd rank choices, β = .25, *p* < .05, but all other effects for μ and τ were not significant, βs < |.17|, *p*s > .10 (Table 5.15). When 2nd rank choices were made, μ was marginally higher when the 1st rank foundation was not chosen, β = .19, *p* < .10. For 2nd rank choices, μ was also marginally lower against 4th rank compared to 5th rank foundations, β = -.25, *p* < .10, while the opposite is true for τ, β = .24, *p* < .10, with τ marginally decreasing for 5th rank compared to 4th rank foundations (Table 5.16). A dissociation in the opposite direction is seen for 3rd rank choices against 2nd rank versus lower rank foundations, with marginally higher μ, β = .23, *p* < .10, and marginally lower τ, β = -.24, *p* < .10 (Table 5.17). When 4th rank choices were made, there was a marginal effect for τ, comparing 2nd rank against lower rank foundations, β = -.27, *p* < .10, with lower τ when 2nd rank foundations were not chosen (Table 5.18). When lowest ranked (5th rank) foundations were chosen, μ was also marginally higher against 2nd rank compared to lower ranked foundations, β = .27, *p* < .10 (Table 5.19). Conversely, τ is marginally lower in these choices, β = -.30, *p* < .10, as well as in choices against 3rd rank compared to 4th rank foundations, β = -.38, *p* < .05.

Taken together, these models suggest a weak pattern with μ decreasing, and τ increasing, for choices between lower ranked foundations, indicating a decreasing time to physically make choices, but increasing decision conflict. Though this is indication that μ and τ parameters are tracking different processes in RT data, this may also be indication of the limitations of an Ex-Gaussian approach here, as we would not expect μ to vary in this way.

Ranks apart split by split by rank chosen on MFCT

Figure 5.11 shows plots for RT, μ and τ for each rank chosen, based on MFCT scores. For mean RT, there were no significant effects, βs < |.13|, *p*s > .10 (see Table

5.15 – Table 5.19), with the exception of significantly higher RT for 1st rank choices against 2nd ranked compared to lower ranked foundations, $\beta = .16$, $p < .10$ (see Table 5.15).

For 1st and 2nd ranked choices, μ was higher against 2nd ranked, $\beta = .22$, $p < .05$, and marginally for 1st ranked foundations respectively, $\beta = .18$, $p < .10$, but all other effects for μ and τ were not significant, βs < |.11|, ps > .10 (Table 5.15 and Table 5.16). For 3rd and 4th ranked choices, μ was also higher against 1st ranked, βs > .40, ps < .01, and 2nd ranked compared to lower ranked foundations, βs > .27, ps < .05 (Table 5.17 and Table 5.18). The opposite is seen for τ, with lower τ against 1st ranked, βs < -.45, ps < .001, and 2nd ranked compared to lower ranked foundations, βs < -.29, ps < .05. For 5th rank choices, μ was marginally higher against 2nd rank compared to lower ranked foundations, $\beta = .28$, $p < .10$ (Table 5.19), with τ marginally lower in choices against 3rd rank compared to 4th rank foundations, $\beta = -.30$, $p < .10$.

Similar to those based on MFQ scores, these models suggest decreasing μ, and increasing τ, for choices between lower ranked foundations, indicating decreasing time to physically make choices, but increasing decision conflict. Though these patterns are clearer when ranks are based on the MFCT, they remain relatively weak and are not reflected in mean RT.

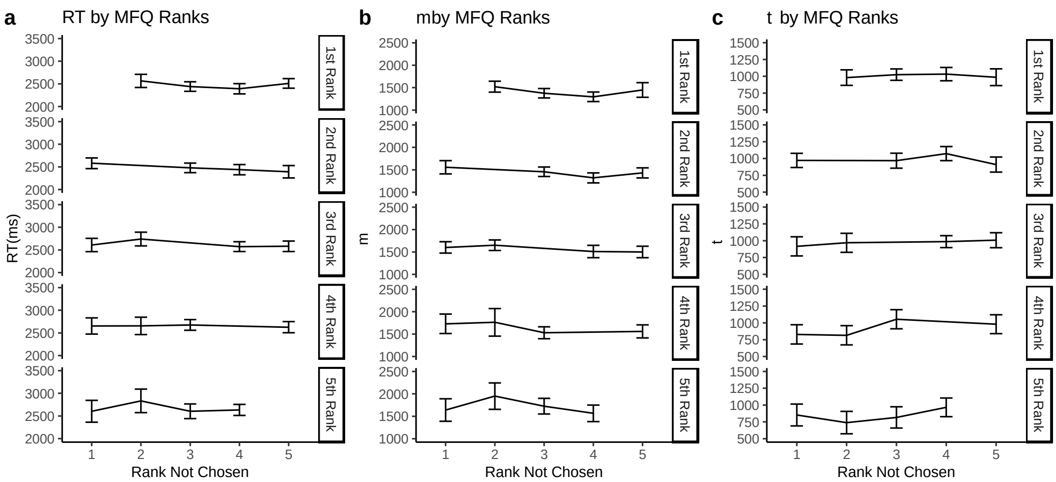

Figure 5.10. Ranks chosen on MFQ, split by ranks not chosen, predicting RT (a), μ (b) and τ (c) in Study 1. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

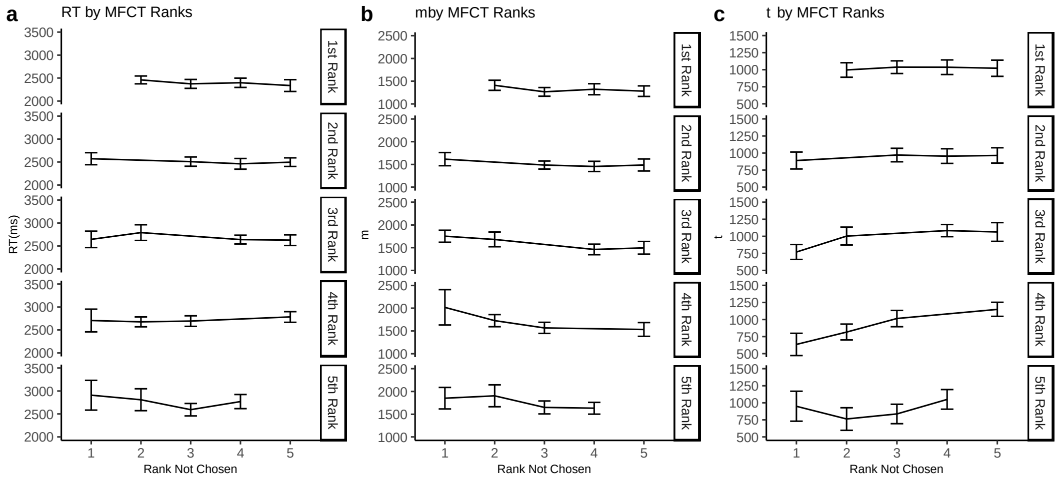

Figure 5.11. Ranks chosen on MFCT, split by ranks not chosen, predicting RT (a), μ (b) and τ (c) in Study 1. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

Table 5.15. Predicting RT, μ and τ for 1st Rank choices on the MFQ and MFCT for Study 1

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	.01 (.11)	-.01 (.09)	.02 (.10)	-.02 (.11)	-.02 (.09)	-.002 (.09)
Ranks Apart						
2 RNC v. 3, 4, 5	.09 (.06)	.25* (.10)	-.07 (.10)	.16** (.06)	.22* (.10)	-.01 (.09)
3 RNC v. 4, 5	-.02 (.06)	.02 (.10)	.02 (.11)	.05 (.06)	-.06 (.11)	.10 (.10)
4 RNC v. 5	-.06 (.08)	-.17 (.14)	-.01 (.14)	.13† (.07)	.11 (.13)	-.01 (.12)
Random effects						
By Subject - σ						
Intercept	.89	.71	.73	.91	.67	.71
Residual	.40	.68	.68	.40	.74	.69
Marginal R^2 / Conditional R^2	.002 / .83	.02 / .53	.001 / .53	.01 / .84	.01 / .46	.002 / .52
LogLik	-241	-330	-332	-255	-364	-352
AIC	495	671	677	523	740	716
BIC	516	693	698	544	762	738

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 263 (MFQ) and 280 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

Table 5.16. Predicting RT, μ and τ for 2nd Rank choices on the MFQ and MFCT for Study 1

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	.02 (.11)	.03 (.09)	.001 (.09)	.002 (.11)	-.01 (.09)	-.002 (.09)
Ranks Apart						
1 RNC v. 3, 4, 5	.11† (.06)	.19† (.10)	-.15 (.10)	.03 (.06)	.18† (.10)	-.01 (.09)
3 RNC v. 4, 5	-.01 (.07)	.10 (.11)	-.08 (.11)	.04 (.07)	.02 (.11)	.10 (.10)
4 RNC v. 5	.05 (.09)	-.25† (.14)	.24† (.14)	-.004 (.08)	-.03 (.13)	-.01 (.12)
Random effects						
By Subject - σ						
Intercept	.88	.70	.68	.88	.67	.63
Residual	.44	.70	.71	.44	.74	.77
Marginal R^2 / Conditional R^2	.003 / .80	.02 / .51	.01 / .49	.00 / .80	.01 / .46	.01 / .41
LogLik	-256	-332	-333	-272	-362	-352
AIC	523	675	679	556	737	716
BIC	544	697	700	578	758	738

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 260 (MFQ) and 279 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

Table 5.17. Predicting RT, μ and τ for 3rd Rank choices on the MFQ and MFCT for Study 1

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	.04 (.11)	.001 (.09)	.02 (.08)	-.003 (.11)	-.005 (.09)	.01 (.08)
Ranks Apart						
1 RNC v. 2, 4, 5	-.08 (.07)	.02 (.11)	-.04 (.13)	-.02 (.07)	.41*** (.11)	-.45*** (.11)
2 RNC v. 4, 5	.003 (.07)	.23† (.12)	-.24† (.14)	.07 (.07)	.29** (.11)	-.29* (.12)

4 RNC v. 5	-.03 (.09)	.05 (.15)	-.12 (.17)	.09 (.09)	-.01 (.13)	.09 (.14)
Random effects						
By Subject - σ						
Intercept	.89	.67	.49	.87	.64	.57
Residual	.45	.72	.87	.47	.74	.79
Marginal R^2 / Conditional R^2	.001 / .80	.01 / .47	.01 / .25	.002 / .78	.04 / .46	.05 / .38
LogLik	-249	-317	-339	-274	-349	-358
AIC	510	646	690	561	711	727
BIC	531	667	711	582	733	749

Note. † p < .10, * p < .05, ** p < .01, *** p < .001. Number of observations = 245 (MFQ) and 270 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

Table 5.18. Predicting RT, μ and τ for 4th Rank choices on the MFQ and MFCT for Study 1

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	.01 (.11)	-.01 (.09)	.002 (.08)	.01 (.11)	.01 (.09)	-.02 (.08)
Ranks Apart						
1 RNC v. 2, 3, 5	-.08 (.07)	.13 (.13)	-.23 (.15)	-.0001 (.07)	.40** (.13)	-.71*** (.14)
2 RNC v. 3, 5	.01 (.08)	.21 (.13)	-.27† (.15)	-.01 (.07)	.27* (.11)	-.33** (.12)
3 RNC v. 5	.03 (.09)	-.04 (.16)	.04 (.18)	-.04 (.08)	.08 (.13)	-.22 (.15)
Random effects						
By Subject - σ						
Intercept	.87	.61	.35	.89	.64	.47
Residual	.44	.77	.92	.42	.74	.82
Marginal R^2 / Conditional R^2	.001 / .80	.01 / .39	.02 / .15	.00 / .81	.04 / .45	.10 / .33
LogLik	-228	-301	-315	-236	-316	-322
AIC	467	614	643	485	644	656
BIC	488	634	663	506	665	677

Note. † p < .10, * p < .05, ** p < .01, *** p < .001. Number of observations = 226 (MFQ) and 243 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised.

Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

Table 5.19. Predicting RT, $\boldsymbol{\mu}$ and $\boldsymbol{\tau}$ for 5th Rank choices on the MFQ and MFCT for Study 1

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	.01 (.14)	.02 (.12)	-.02 (.11)	.03 (.13)	.05 (.11)	-.05 (.10)
Ranks Apart						
1 RNC v. 2, 3, 4	-.01 (.08)	-.08 (.15)	-.15 (.15)	.13 (.12)	.15 (.17)	-.19 (.19)
2 RNC v. 3, 4	.10 (.08)	.27† (.15)	-.30† (.15)	.07 (.10)	.28† (.15)	-.21 (.16)
3 RNC v. 4	-.08 (.09)	.25 (.16)	-.38* (.16)	-.12 (.10)	.03 (.14)	-.30† (.16)
Random effects						
By Subject - σ						
Intercept	.90	.64	.62	.87	.66	.54
Residual	.40	.74	.75	.50	.73	.82
Marginal R^2 / Conditional R^2	.003 / .83	.02 / .44	.04 / .44	.01 / .76	.02 / .46	.03 / .32
LogLik	-142	-201	-201	-188	-225	-234
AIC	297	415	415	388	461	479
BIC	315	433	433	407	480	498

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 155 (MFQ) and 172 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

5.1.3 Discussion

The MFCT aims to directly map intuitive foundations through inter-foundation conflict, and compare these to self-reported foundation endorsement on the MFQ. We found that foundation rankings measured on the MFQ and emerging from the MFCT correlated at r_{τ} (75) = .50. We broadly interpret the MFCT scores as indicators of *intuitive* foundation endorsement, and hence interpret this finding as a substantial but imperfect match between intuitive and explicitly reported foundation endorsement.

However, it may be that the MFCT is merely capturing noisy and fast deliberated judgments, a possibility we aim to eliminate in Studies 2 and 3.

A key potential strength of the MFCT over the MFQ is that it yields response time data, providing a metric for difficulty and conflict in decisions between foundations. We expected that when foundations are more closely matched, i.e. have a smaller difference in scores, decisions between them will take longer, reflective of greater conflict. We found that differences in MFQ scores, as measures of how valued foundations are, predicted response time when these foundations were in conflict on the MFCT, such that a greater difference was associated with faster reaction time. To further probe conflict, we modelled RT and Ex-Gaussian parameters based on how many ranks apart foundations are in participants' rank orderings of MFQ scores. We found that, in general, response time and τ, isolating conflict in decision-making, decreased with increasing ranks apart. Furthermore, we found some differences in effects when how much value placed on each foundation is taken into account.

These patterns are mirrored with slightly larger effects, when scores indicating the value of foundations are derived from the task itself, an indicator of consistency within the MFCT. Furthermore, patterns in RT illustrate the potential value of analysing response time data collected from the MFCT as a signifier of inter-foundation conflict. However, all these models of RT leave a large proportions of variance unexplained, and effects are relatively weak. Further exploration of RT on the MFCT will benefit from larger sample sizes, a limitation of this study we aim to address in Study 5.

6 Chapter 6: Cognitive load on the Moral Foundations Conflict Task

6.1 Study 2

A number of studies have attempted to explore the structure of foundations at the intuitive levels by manipulating cognitive load (e.g. Wright & Baril, 2011 – see Chapter 2.3). Evidence regarding whether individuals are deliberately correcting their moral intuitions – either by suppressing them or enhancing other concerns at the explicit level – is, at the present, inconsistent and conflicting. Study 2 aims to examine whether the response patterns on the MFCT are affected by availability of cognitive resources. Particularly, we are interested in whether the relationship between the intuitive responses on the MFCT and explicit responses on the MFQ would be affected by increasing cognitive load during the MFCT, using a concurrent task to divide attention (derived from Skitka et al., 2002). This study was developed in collaboration with Marr (2016), who added the concurrent task to the MFCT and collected this data for separate and independent analysis for a masters thesis.

If responses on the MFCT are not intuitively-driven – as we propose – but are instead merely reflective of noisy and fast deliberated judgments, we would expect that increasing cognitive load will interfere with this process, depleting ability to deliberately correct any intuitive reactions and thus reducing the correlation between MFCT scores and MFQ scores. Furthermore, there would also be evidence of greater conflict between foundations under cognitive load as unsuppressed intuitions clash, with longer response times, and greater τ values in the divided attention condition. However, if the MFCT is capturing intuitively-driven judgments, we would expect the correlation between MFCT scores and MFQ scores to remain stable, and little indication of increased conflict under cognitive load.

6.1.1 Method

Participants

One-hundred participants were recruited through university networks and were randomly assigned to participate in either a control or a cognitive load condition. Sample size was identified on the basis of a G*power analysis, α = .05 and β = .20, for a medium effect size (Cohen's q = .50) for a one-tailed test of difference between two independent correlations. We assume a Kendall rank correlation coefficient of ~.50 in the control condition (based on Study 1), and expected a decrease to a medium correlation of ~.20 in the load condition. All participants were required to be fluent English speakers. Participants were paid 3 GBP for their time. One participant was removed due to missing data, leaving a final sample of 99 participants (79% females, M_{age} = 22.79; SD_{age} = 3.13) for analysis, with 50 participants in the control condition and 49 in the load condition. Figure 6.1 shows a histogram of the distribution of RTs. Applying the same RT criteria as in Study 1, a total of twenty-five trials (<.01%) were removed across 16 subjects, leaving a total of 15,829 trials ($M_{RT\ Control}$ = 2280ms; $SD_{RT\ Control}$ = 1467ms; $M_{RT\ Load}$ = 2331ms; $SD_{RT\ Load}$ = 1502ms).

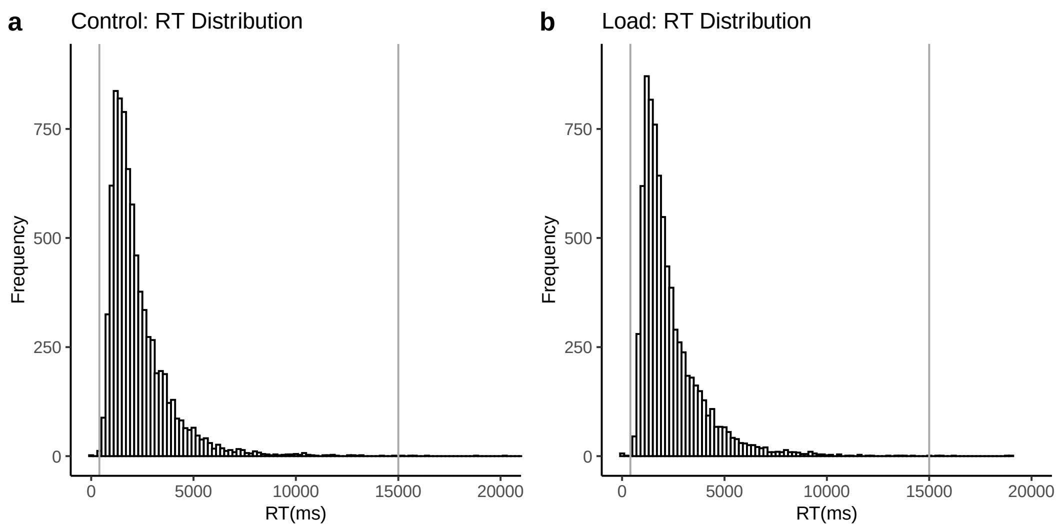

Figure 6.1. Distribution of RTs across all trials in Study 2. Grey reference lines indicate cut-off points of 400ms and 15,000ms.

Measures and Procedure

As in Study 1, participants completed the MFQ and MFCT in randomised order. Subscale reliabilities on the MFQ for Study 2 (αs: care = .58; fairness = .55; authority = .67; loyalty = .68; purity = .79) were similar to those found in Study 1 (αs: care = .38; fairness = .55; authority = .63; loyalty = .71; purity = .79).

Cognitive load manipulation

Participants in the load condition completed an adapted version of the MFCT, identical but for the addition of a concurrent tone-counting task (see Skitka et al., 2002). Throughout each block, participants heard a series of tones (one tone every 2 seconds) through headphones. The tones were either high or low pitched (with a ratio of 40% high to 60% low) in a random order. The series of tones was different for each block. Participants were instructed to count the number of high pitched tones and ignore the low pitched tones at the same time as completing the MFCT. The number of high-pitched tones heard depended on how long participants spent on each block. At the end of each block, an additional screen required participants to input the number of high pitched tones heard to continue to the next block.

Load participants completed an additional four items designed to gauge the perceived performance and difficulty on the tone-counting task, and how much they felt the cognitive load manipulation interfered with their performance: 'How difficult did you find the decision making task?'; 'How much did having to count the tones interfere with your ability to choose between the words or phrases?'; 'How accurate do you think you were in the counting tones?'; and 'How much do you think your responses on the decision making task reflected your beliefs/values?'(scaled from 1 to 10).

6.1.2 Results

For Study 2, we replicate analyses for Study 1, separating results into three main sections, first assessing the effects of the structure of the MFCT, before exploring correlations between responses on the MFCT and scores on the MFQ, and RTs on the MFCT as indicators of conflict in decisions between foundations. To address predictions for Study 2, we examine differences in correlations between the MFQ and the MFCT, and differences in RT, across conditions. Finally, we assess performance and perceived performance for participants in the load condition.

Results from analyses pertaining to the properties of items and block structure of the MFCT were consistent with those in Study 1. Across all analyses, we did not find any evidence of consistent effects of condition. In particular, we did not find evidence for a difference in the correlation between the MFQ and MFCT, nor for a difference in RT patterns, between conditions.

Structure of MFCT

We replicated effects in Study 1 of effects of item valence score and length, and interpret them similarly. These models are reported in Appendix 2.

Effect of blocks

Analyses assessed whether condition and blocks on the MFCT had any effect on responses and RT patterns (see Table 6.1). There was no main effect for condition, $\beta = -.002$, $p > .10$, nor any interactions between condition, valence, action or foundation, βs < $|.27|$, $p > .10$, on MFCT scores. There was also no main effect of condition for RT, $\beta = -.04$, $p > .10$, nor interaction between condition and valence, $\beta = .06$, $p > .10$. There was an interaction between condition and action, $\beta = .08$, $p < .05$, with a larger difference between choices on active and passive trial in the control versus load condition. Choosing fairness had longer RTs relative to choosing care in the load condition, $\beta = .10$, $p < .01$, but all other interactions between condition and foundation were not significant, βs < $|.04|$, ps > .10, as were all other interactions including condition, βs < $|.20|$, ps > .10.

As in Study 1, neither the valence, nor the action formulation of items, nor the interaction between valence and action, had an effect on MFCT scores. However, the interaction between valence and action did affect RT, $\beta = -.38$, $p = < .001$.with passive items again being faster in the virtue block.

Also as in Study 1, there was a significant effect of foundation on MFCT scores, with binding foundations being chosen less than individualising foundations, $\beta = -.92$, $p < .001$. This is reflected in RTs, with binding foundations chosen slower than individualising foundations, $\beta = .27$, $p < .001$. As in Study 1, this likely reflects the fact that most participants were liberal, hence generally prioritising individualising foundations, and taking less time to choose them. Significant interactions between valence, action, and foundation can be seen in Table 6.1, Figure 6.2 and Figure 6.3.

Table 6.1. MFCT score and RT by condition, blocks, and foundation for Study 2

	Models	
	MFCT Score	log RT
Fixed effects		
Intercept	-.002 (.05)	.28*** (.08)
Condition (Load v. Control)	-.002 (.07)	-.04 (.12)
Valence (Virtue v. Vice)	-.001 (.07)	-.05* (.03)
Action (Passive v. Active)	< .001 (.07)	-.38*** (.03)
Foundation		
Binding v. Individualising	-.92*** (.12)	.27*** (.04)
Fairness v. Care	-.54*** (.08)	.07** (.03)
Loyalty v. Authority	.30*** (.09)	-.10** (.03)
Purity v. Authority	-.39*** (.09)	.14*** (.04)
Condition : Valence	.002 (.10)	.06 (.04)
Condition : Action	.002 (.10)	.08* (.04)
Valence : Action	< .001 (.10)	-.24*** (.04)
Condition : Foundation		
Condition : Binding v. Individualising	-.11 (.17)	.01 (.06)
Condition : Fairness v. Care	-.02 (.11)	.10** (.04)
Condition : Loyalty v. Authority	.06 (.12)	.02 (.05)
Condition : Purity v. Authority	.09 (.12)	-.04 (.05)
Valence : Foundation		
Valence : Binding v. Individualising	-.57*** (.17)	-.11† (.06)
Valence : Fairness v. Care	.80*** (.11)	-.12*** (.04)
Valence : Loyalty v. Authority	.04 (.12)	.10* (.05)
Valence : Purity v. Authority	.62*** (.12)	-.12* (.05)
Action : Foundation		
Action : Binding v. Individualising	-.51** (.17)	-.06 (.06)
Action : Fairness v. Care	-.06 (.11)	.03 (.04)
Action : Loyalty v. Authority	.06 (.12)	.18*** (.05)
Action : Purity v. Authority	.29* (.12)	-.23*** (.05)
Condition : Valence : Action	.0002 (.14)	.01 (.05)
Condition : Valence : Foundation		
Condition : Valence : Binding v. Individualising	-.09 (.24)	-.05 (.09)

Condition : Valence : Fairness v. Care	-.14 (.15)	-.02 (.05)
Condition : Valence : Loyalty v. Authority	-.01 (.18)	-.03 (.07)
Condition : Valence : Purity v. Authority	-.11 (.18)	.05 (.07)
Condition : Action : Foundation		
Condition : Action : Binding v. Individualising	.18 (.24)	-.12 (.09)
Condition : Action : Fairness v. Care	.12 (.15)	-.05 (.05)
Condition : Action : Loyalty v. Authority	-.20 (.18)	-.03 (.07)
Condition : Action : Purity v. Authority	-.07 (.18)	.01 (.07)
Valence : Action : Foundation		
Valence : Action : Binding v. Individualising	.74** (.24)	-.03 (.09)
Valence : Action : Fairness v. Care	-.47** (.15)	.07 (.05)
Valence : Action : Loyalty v. Authority	-.62*** (.18)	-.13† (.07)
Valence : Action : Purity v. Authority	-.84*** (.18)	.18* (.07)
Condition : Valence : Action : Foundation		
Condition : Valence : Action : Binding v. Individualising	.04 (.34)	.20 (.12)
Condition : Valence : Action : Fairness v. Care	.01 (.22)	-.04 (.07)
Condition : Valence : Action : Loyalty v. Authority	.12 (.25)	-.02 (.10)
Condition : Valence : Action : Purity v. Authority	.03 (.25)	.03 (.11)
Random effects		
By Subject - σ		
Intercept	< .001	.56
Residual	.75	.79
Marginal R^2 / Conditional R^2	.43 / .43	.07 / .38
LogLik	-2,250	-18,899
AIC	4,584	37,882
BIC	4,819	38,204

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 1,980 (MFCT Score) and 15,829 (log RT). Fixed and random effects for separate models predicting MFCT score and log RT. Outcome variables have been standardised. For RT model, foundation represents the foundation of the item chosen in a given trial. Planned contrasts for foundation compare individualising to binding foundations (with the former as the reference level), and then compare Care to Fairness (former as reference level), and Authority to Loyalty and Purity (Authority as reference level). For condition, valence and action: control, vice and active are reference levels. For fixed effects, *SE* is provided in parentheses.

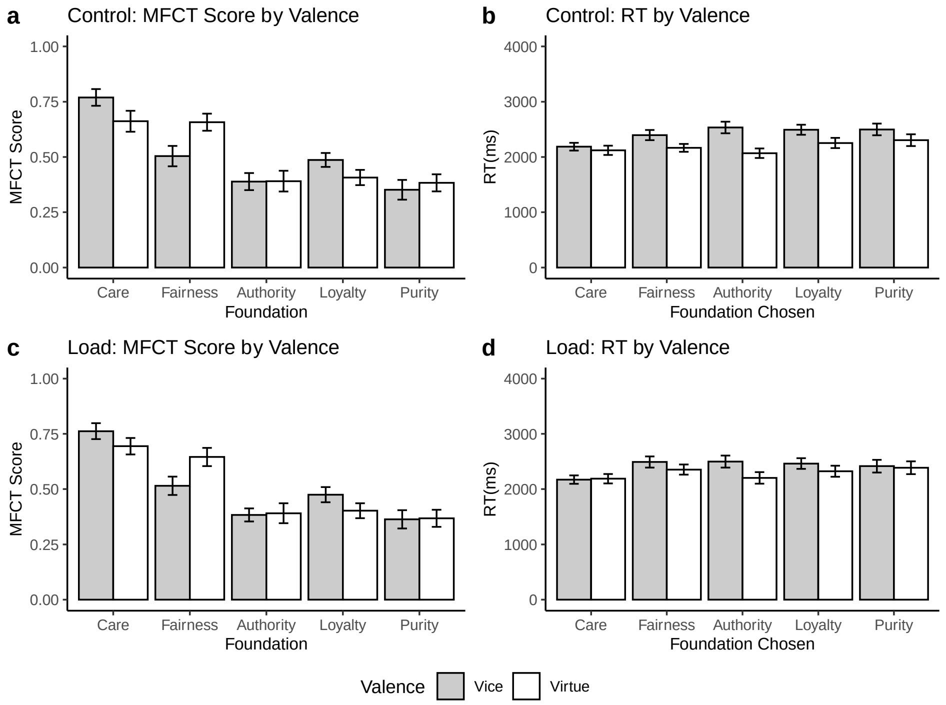

Figure 6.2. MFCT score (a, c) and RT (b, d) for control (a, b) and load (c, d) conditions by valence block and foundation in Study 2. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

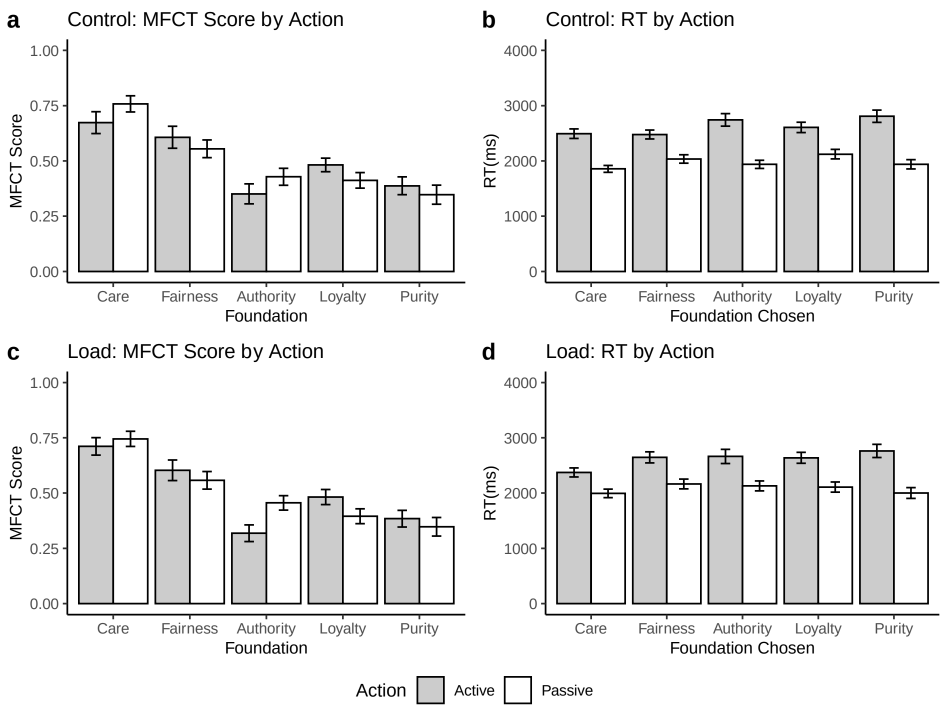

Figure 6.3. MFCT score (a, c) and RT (b, d) for control (a, b) and load (c, d) conditions by action block and foundation in Study 2. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

Within-subject mean RTs and Ex-Gaussian parameters were fit for each block (see Table 6.2 and Figure 6.4). There was a marginal effect of condition on μ, β = -.36, p < .10, with lower μ, and thus lower processing speed, in the load condition. There were no effects of condition on mean RT, β = -.01, p > .10, or on τ, β = .25, p > .10. There is a marginal interaction between condition and action, β = .17, p < .10, with a larger difference between choices on active and passive trials in the control versus load condition. All other interactions with condition were not significant, βs = |.22|, ps > .10.

Here, the interaction between valence and action predicted mean RT, β = -.38, p < .001, and marginally predicted μ, β = -.32, p < .10, indicating faster processing speed for passive virtue items. In contrast to Study 1, this interaction was also significant for τ, β = -.35, p < .05, indicating greater conflict for passive virtue items.

Table 6.2. RT, μ and τ by condition and blocks for Study 2

	Models		
	log RT	log μ	log τ
Fixed effects			
Intercept	.34* (.13)	.50*** (.13)	-.02 (.14)
Condition (Load v. Control)	-.01 (.19)	-.36† (.19)	.25 (.20)
Valence (Virtue v. Vice)	-.05 (.07)	-.04 (.13)	.06 (.12)
Action (Passive v. Active)	-.55*** (.07)	-.51*** (.13)	-.18 (.12)
Condition : Valence	.08 (.09)	.22 (.19)	-.07 (.18)
Condition : Action	.17† (.09)	-.07 (.19)	.18 (.18)
Valence : Action	-.38*** (.09)	-.32† (.19)	-.35* (.18)
Condition : Valence : Action	.01 (.13)	-.02 (.26)	.11 (.25)
Random effects			
By Subject - σ			
Intercept	.87	.65	.75
Residual	.33	.65	.62
Marginal R^2 / Conditional R^2	.13 / .89	.16 / 0.58	.06 / .62
LogLik	-289	-470	-466
AIC	598	961	953
BIC	638	1,000	993

Note. † p < .10, * p < .05, ** p < .01, *** p < .001. Number of observations = 396. Fixed and random effects for separate models predicting log RT, μ and τ. Outcome variables have been standardised. For condition, valence and action: control, vice and active are reference levels. For fixed effects, *SE* is provided in parentheses.

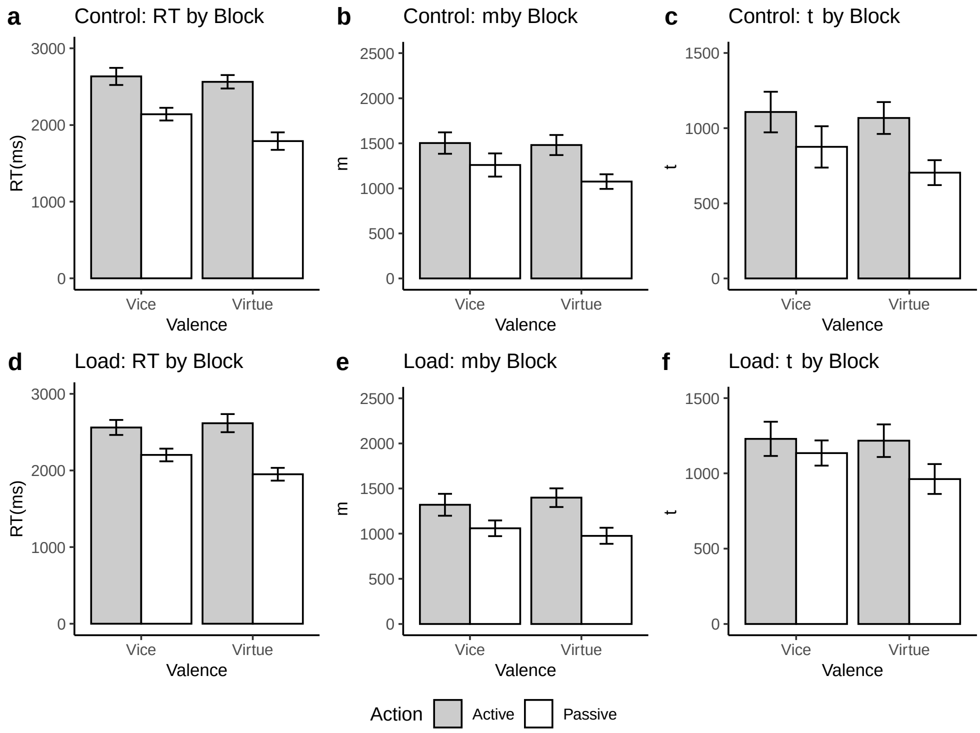

Figure 6.4. Mean RT (a, d), μ *(b, e)* and τ (c, f) for control (a-c) and load (d-f) by blocks. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

Consistent with results for Study 1, these analyses indicate that the block structure of the task impacts response patterns and RTs on the MFCT. For RT, it is quicker and easier to make choices between virtue and passive items.

As in Study 1, we assessed internal reliability of the full MFCT and for each block, collapsing across conditions. Table 6.3 shows split-half reliability coefficients. Reliability is acceptable for the full task, and across blocks.

Table 6.3. Bootstrapped split-half reliability across blocks for Study 2

	r_{Boot}	Bias	95% CI of *r*	*SE* r_{Boot}
Study 2 (*N* = 99)				
Full Task	.81	.01	[.76, .85]	.02
Vice	.77	-.01	[.71, .85]	.04
Virtue	.80	-.01	[.76, .85]	.02
Active	.80	-.03	[.76, .88]	.03
Passive	.76	.01	[.69, .81]	.03

Note. Bootstrapped with 5,000 iterations.

Correlating MFQ and MFCT Scores

Mean responses and correlation across foundations are shown in Table 6.4. The correlations for care, $r = .46$, $p <. 001$, authority, $r = .54$, $p < .001$, loyalty, $r = .50$, $p < .001$, and purity, $r = .58$, $p < .001$ were all significant, however this was again not the case for fairness, $r = .24$, $p > .10$.

Table 6.4. Descriptive statistics and Pearson correlations for Study 2 variables

	M	*SD*	1	2	3	4	5	6	7	8	9
1. Care-MFQ	3.92	.59	-								
2. Fairness-MFQ	3.94	.48	.33**	-							
3. Authority-MFQ	2.21	.73	-.01	.10	-						
4. Loyalty-MFQ	2.39	.76	.12	-.04	.62***	-					
5. Purity-MFQ	1.73	.98	.15	.04	.62***	.50***	-				
6. Care-MFCT	.72	.14	**.46*****	.08	-.51***	-.40***	-.33**	-			
7. Fairness-MFCT	.58	.14	-.19	**.24**	-.36**	-.40***	-.46***	.02	-		
8. Authority-MFCT	.39	.10	-.26†	-.12	**.54*****	.22	.30*	-.54***	-.37**	-	
9. Loyalty-MFCT	.44	.10	.02	-.19	.19	**.50*****	.10	-.22	-.50***	.05	-
10. Purity-MFCT	.37	.13	-.11	-.12	.38***	.32**	**.58*****	-.53***	-.44***	.17	-.04

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. MFQ scores are on a 0 to 5 scale, MFCT scores are on a 0 to 1 scale. *p*-values corrected for multiple comparisons (Bonferroni). Correlations between the same foundations on the MFQ and on the MFCT have been highlighted in bold.

Kendall rank correlation coefficients between MFCT to MFQ responses, calculated for each participant, ranged from -.89 to 1.00, with a mean of $r_\tau\,(99) = .56$. To assess stability, this estimate was bootstrapped to give an estimate of $r_{\tau Boot} = .58$ (*SE* $r_{\tau Boot} = .04$, *95% CI* [.52, .67]). There was no evidence for a difference between correlations in the control, $r_\tau\,(50) = .53$, and load conditions, $r_\tau\,(49) = .59$, *95% CI* [-.23, .11] (see Table 6.5).

This comparison is a crucial test of our hypotheses, and we therefore conducted further analysis in order to interpret this non-significant result. As the distribution of participants' correlations between their MFQ and MFCT scores is highly negatively skewed, we conducted a non-parametric Mann–Whitney U test of the difference between mean correlations between conditions, alongside a Bayes factor for this test.

In order to calculate a non-parametric Bayes factor (BF_{10}), we followed an approach developed by van Doorn, Ly, Marsman, and Wagenmakers (2020). We confirmed non-significance, $U = 1100.00$, $Z = -.88$, $p = .40$, $r = .09$, and calculated a BF_{10} of .26. To interpret this Bayes factor, we apply conventional cut-offs (Jeffreys, 1939/1961; Lee & Wagenmakers, 2014), interpreting a value less than 1/3 as moderate evidence for the null hypothesis that there is no difference between mean correlations across conditions.

Table 6.5. Correlations between MFQ and MFCT scores across conditions for Study 2

	Sample r_τ	$r_{\tau Boot}$	Bias	95% CI of r_τ	$SE\ r_{\tau Boot}$	95% CI of Difference
Control (N = 50)	.53	.48	.050	[.34, .54]	.053	[-.23 , .11]
Load (N = 49)	.59	.65	-.060	[.61, .76]	.053	

Note. Bootstrapped with 5,000 iterations. CIs are the Bias Corrected Accelerated (BCa) intervals

As in Study 1, there was no evident difference in correlations in for vice and virtue blocks, *95% CI* [-.22, .02], nor between the active and passive blocks, *95% CI* [-.18, .06], with CIs that include 0 indicating non-significant difference between correlations (see Table 6.6).

Table 6.6. Correlations between MFQ and MFCT scores across blocks for Study 2

	Sample r_τ	$r_{\tau Boot}$	Bias	95% CI of r_τ	$SE\ r_{\tau Boot}$	95% CI of Difference
Study 2 (N = 99)						
Full Task	.56	.58	-.019	[.52, .67]	.038	
Vice	.44	.39	.053	[.29, .42]	.040	[-.22 , .02]
Virtue	.56	.54	.021	[.44, .59]	.035	
Active	.47	.46	.012	[.37, .52]	.037	[-.18 , .06]
Passive	.53	.52	.006	[.44, .59]	.039	

Note. Bootstrapped with 5,000 iterations. CIs are the Bias Corrected Accelerated (BCa) intervals

Replicating correlations from Study 1, these results indicate a 56% match between the order, or ranks, of foundation endorsement measured by the MFQ and foundation preference expressed in the MFCT, stable across all blocks of the task. Contrary to our prediction that – if choices on the MFCT result from fast deliberation – the correlation between MFCT scores and MFQ scores would be lower in the load condition, there was no difference between conditions.

Predicting RT on the MFCT

We replicate exploratory analyses conducted in Study 1 to explore RT as an indicator of conflict in decisions between foundations, that varies based on how valued two foundations are, as measured by endorsement on the MFQ, and by overall preferences on the MFCT. We include condition as a predictor in these analyses to test predictions that there will be greater conflict between foundations under cognitive load, apparent in longer RTs, and greater τ values, in the load condition.

Difference in foundation scores predicting RT

As in Study 1, we expected that RT would be highest when the difference is 0 indicating that two foundations are equally valued, and that the effect on RT would be non-linear. Separate multilevel models (see Table 6.7) were fit to predict RT from linear (x) and quadratic (x_2) terms for the difference between MFQ and MFCT scores. Figure 6.5 plots these quadratic regressions.

For MFQ scores, the linear term was marginally significant, $\beta = -.07$, $p < .10$, in the expected direction, with RT decreasing as the difference in MFQ scores increases. However, as in Study 1, the quadratic term was not significant, $\beta < |.001|$, $p > .10$. As also found in Study 1, for MFCT scores, the linear term was not significant, $\beta = .01$, $p > .10$, though the quadratic term was significant in the predicted direction, $\beta = -.03$, $p < .05$. This may further suggest that the relationship is linear for MFQ scores, and quadratic for MFCT scores. However, as in Study 1, these effects are small. There was no effect of condition, nor any interactions between condition and any other terms in the models, βs < |.08|, ps > .10.

Table 6.7. Predicting RT from condition and difference in MFQ and MFCT scores for Study 2

	Models	
	log RT	
Fixed effects		
Intercept	.08 (.08)	.07 (.08)
Condition (Load v. Control)	-.01 (.12)	.01 (.12)
Difference in MFQ Scores	-.07† (.04)	
Difference in MFQ Scores^2	-.0004 (.01)	
Condition : Difference in MFQ Scores	.08 (.06)	
Condition : Difference in MFQ Scores^2	-.02 (.02)	

Difference in MFCT Scores		-.01 (.04)
Difference in MFCT Scores^2		-.03* (.01)
Condition : Difference in MFCT Scores		.003 (.06)
Condition : Difference in MFCT Scores^2		.01 (.02)
Random effects		
By Subject - σ		
Intercept	.56	.56
Foundation Combination	< .001	< .001
Valence	< .001	< .001
Action	.34	.33
Residual	.76	.76
Marginal R^2 / Conditional R^2	.004 / .43	.01 / .43
LogLik	-19,448	-19,421
AIC	38,918	38,864
BIC	39,002	38,949

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 15,829. Fixed and random effects for separate models predicting log RT. Outcome variables have been standardised. Quadratic models fit terms for difference in scores (x) and squared difference in scores (x^2) between foundations in a trial. In order to preserve a minimum value of 0 interpretable as no difference between scores for the quadratic term, difference predictors in these models were scaled by SD without centring. For condition: control is the reference level. For fixed effects, *SE* is provided in parentheses.

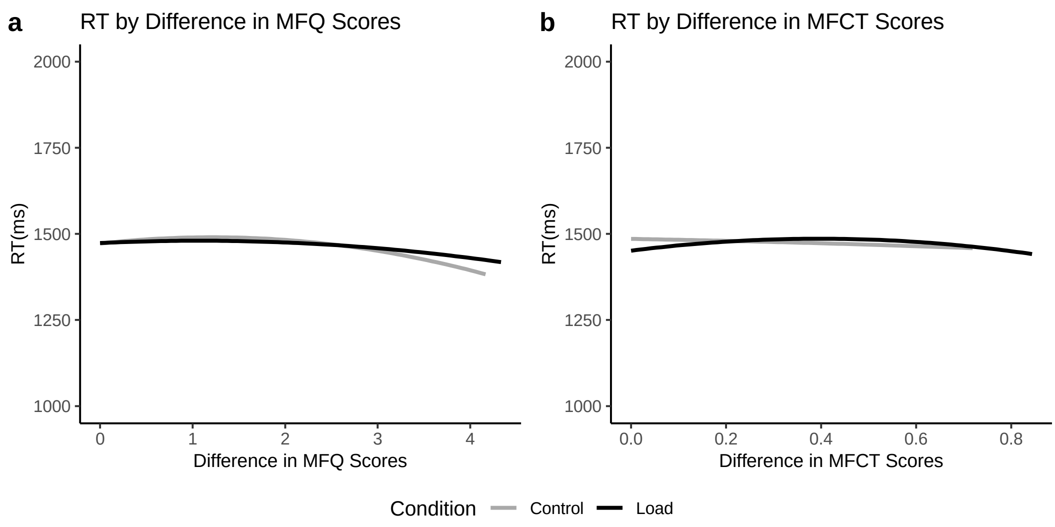

Figure 6.5. Predicting RT for Study 2 with quadratic models for (a) difference in MFQ scores and (b) difference in MFCT scores between foundations in a trial. Grey areas represent 95% CI boundaries.

Ranks apart predicting RT

Figure 6.6 and Figure 6.7 show histograms for within-subject mean RTs, μ and τ calculated for ranks apart categories in each condition based on the MFQ and MFCT, respectively.

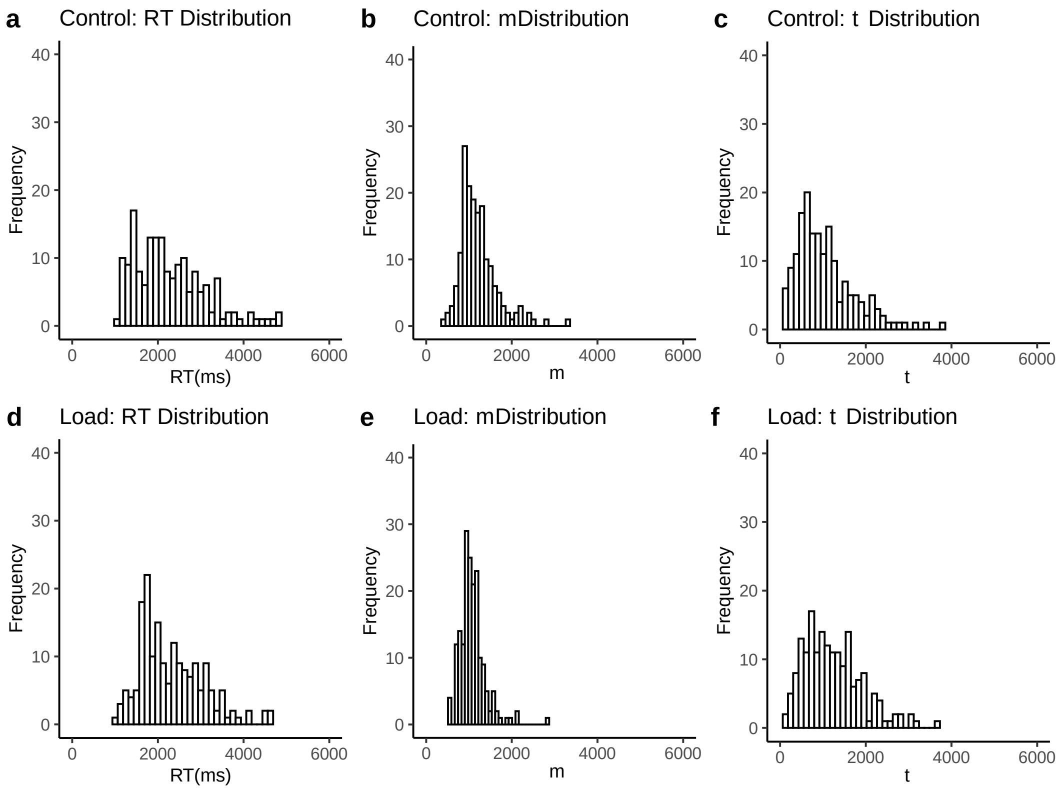

Figure 6.6. Distribution of RT (a), μ (b) and τ (c) across MFQ rank apart categories in Study 2

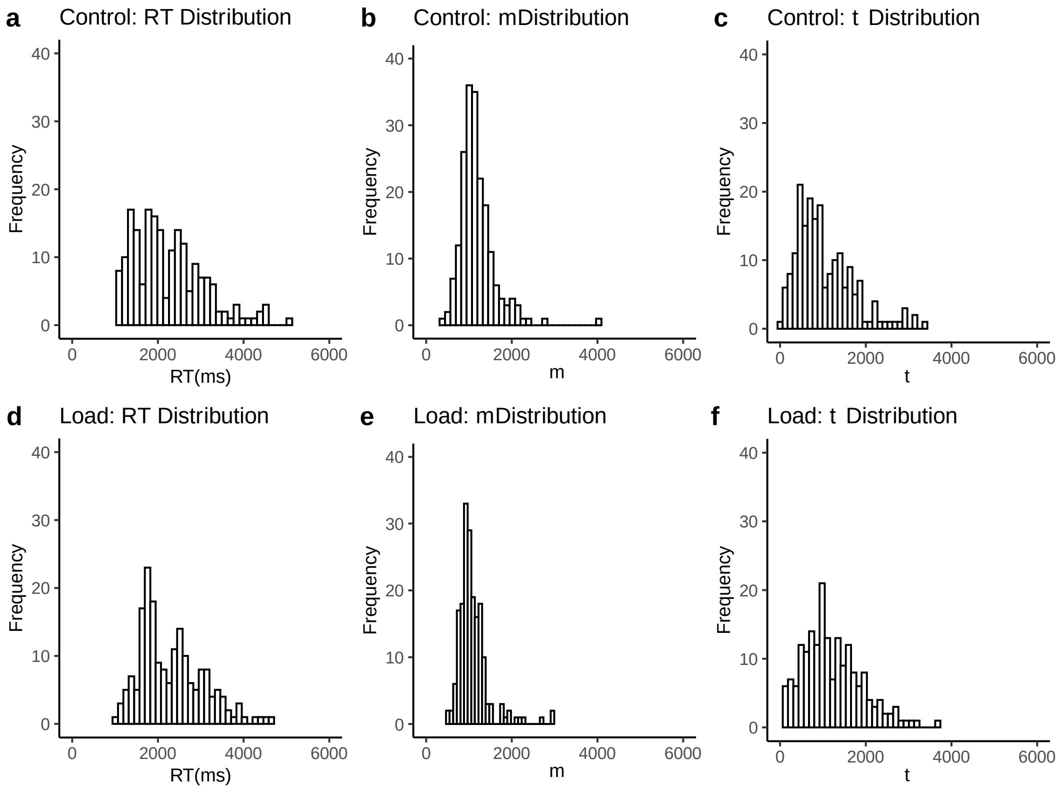

Figure 6.7. Distribution of RT (a), μ (b) and τ (c) across MFCT rank apart categories in Study 2

As in Study 1, multilevel models (see Table 6.8) were fit to predict RT, μ and τ, based on how many ranks apart foundations in each trial are based on each participant's rank ordering, or order of foundations endorsement/preference. A total of 37 and 13 participants had equally scored foundations on the MFQ and MFCT, respectively. For these participants, following equally ranked foundations subsequent ranks were labelled sequentially, as in Study 1. Models were fit with a set of planned contrasts (Helmert coding), testing whether the former increases with fewer ranks apart. As in Study 1, equally valued choices (0 ranks apart) were dropped from models.

Ranks apart on MFQ

As for Study 1, a weak trend of decreasing RT and τ, as the number of ranks apart increases, can be seen in Figure 6.8 (panels a and c).

Mean RT was higher RT in choices between foundations one rank apart on the MFQ, β = .17, p < .001, and two rank apart choices, β = .11, p < .05, relative to subsequent ranks apart. There was also higher τ in one rank apart choices, β = .27, p < .01, relative to further apart choices, with no evident differences in τ for other comparisons, βs < |.09|, *p*s > .10. For μ, there is a marginal effect for two rank apart versus subsequent ranks apart, β = .21, p < .10, with no other differences, βs < |.14|, *p*s > .10.

There are no main effects of condition, βs < |.29|, *p*s > .10, and no evidence of interactions between condition and ranks apart for mean RT, βs < |.06|, *p*s > .10. For τ, there is an interaction between condition and ranks apart for two ranks apart choices, β = .29, p < .05, and a marginally for three rank apart choices, β = .30, p < .10, such that the predicted downward trend can be seen in the load, but not the control condition. For μ, there is also an interaction between condition and ranks apart for two ranks apart choices, β = .28, p < .10, in the opposite direction to τ, with higher μ in the control condition for two ranks apart choices, relative to subsequent ranks apart.

Ranks apart on MFCT

As in Study 1, the expected decreasing trend in RT and τ is clearer for ranks apart based on the task itself (see Figure 6.9, panels a and c). Mean RT decreases with ranks apart in the predicted direction, βs > .16, *p*s < .01, as does τ, βs > .22, *p*s < .10. There is a marginal effect for μ for one rank apart choices relative to four rank apart choices, β = .20, p < .10, but no other planned contrast were significant for μ, βs < |.13|, *p*s > .10.

As for ranks apart derived from MFCT scores, there are no main effects of condition, βs < |.29|, *p*s > .10. For mean RT, there is a marginal interaction between condition and one rank apart choices, β = -.13, p < .10, but all other interactions for mean RT, τ, and μ, are not significant, βs < |.23|, *p*s > .10.

Table 6.8. Predicting RT, μ and τ from condition and ranks apart on the MFQ and MFCT for Study 2

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	-.10 (.14)	.11 (.12)	-.18 (.13)	-.09 (.14)	.13 (.12)	-.17 (.13)
Condition (Load v. Control)	.13 (.20)	-.25 (.17)	.29 (.18)	.14 (.20)	-.27 (.17)	.29 (.18)
Ranks Apart						
1 RA v. 2, 3, 4	.17*** (.05)	.01 (.11)	.27** (.09)	.23*** (.05)	.20† (.11)	.27** (.09)
2 RA v. 3, 4	.11* (.05)	.21† (.12)	-.04 (.10)	.16** (.05)	-.04 (.11)	.31** (.10)

3 RA v. 4	.05 (.07)	.14 (.16)	-.09 (.13)	.18** (.06)	-.13 (.13)	.22† (.11)
Condition : Ranks Apart						
Condition : 1 RA v. 2, 3, 4	-.05 (.07)	.04 (.15)	-.13 (.12)	-.13† (.07)	-.08 (.15)	-.15 (.13)
Condition : 2 RA v. 3, 4	.01 (.08)	-.28† (.17)	.29* (.14)	-.04 (.07)	.14 (.16)	-.16 (.14)
Condition : 3 RA v. 4	.06 (.10)	-.24 (.22)	.30† (.17)	-.05 (.09)	.20 (.19)	-.23 (.16)
Random effects						
By Subject - σ						
Intercept	.96	.78	.83	.96	.76	.83
Residual	.28	.63	.51	.29	.64	.54
Marginal R^2 / Conditional R^2	.01 / .92	.02 / .61	.04 / .74	.02 / .92	.03 / .60	.04 / .71
LogLik	-236	-425	-375	-252	-461	-422
AIC	492	870	770	525	942	865
BIC	531	909	809	564	981	904

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 350 (MFQ) and 382 (MFCT). RA – Ranks Apart. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. Helmert coding compares each rank apart category to the mean of the subsequent categories. For condition: control is the reference level. For fixed effects, *SE* is provided in parentheses.

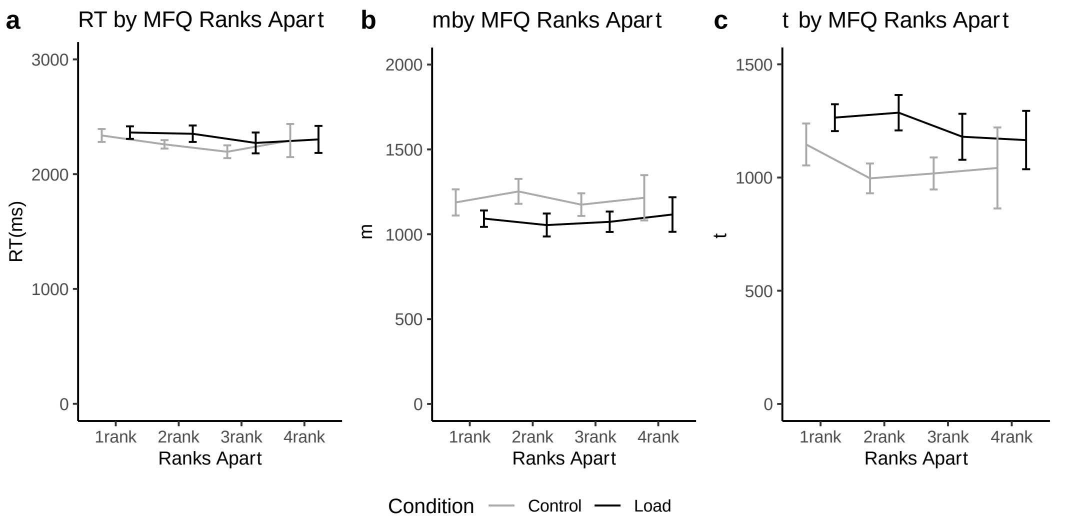

Figure 6.8. Condition and ranks apart on MFQ predicting RT (a), μ (b) and τ (c) for Study 2. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

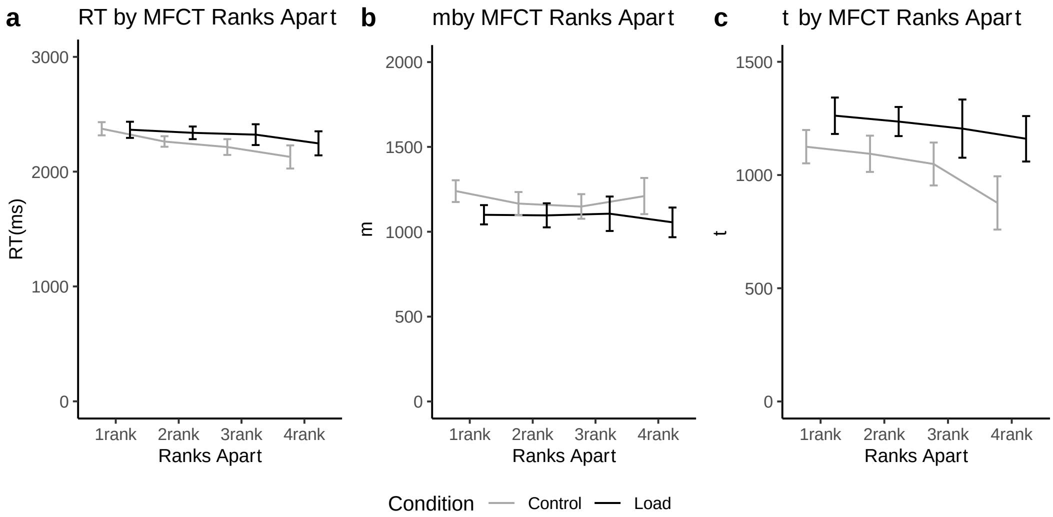

Figure 6.9. Condition and ranks apart on MFCT predicting RT (a), μ (b) and τ (c) for Study 2. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

These analyses replicate the noisy patterns found for Study 1, suggesting that foundations endorsement/preference is reflected in RTs on the MFCT. Figure 6.8 and Figure 6.9 suggest higher τ in the load condition, though this is not significant.

Weighted ranks apart predicting RT

The above ways of operationalising the difference in value between foundations do not account for *how much* value is placed on each foundation, and therefore, as for Study 1, we ran a number of analyses attempting to better account for this. We report all these analyses in Appendix 2. Here, we present models based on weighted ranks apart as the clearest means of accomplishing this.

As in Study 1, we fit models (see Table 6.9) that included a bias term for the ranks in a choice to weight the number of ranks apart foundations are in each trial, with a higher mean rank for foundations in a choice indicating higher value.

For ranks based on both MFQ and MFCT scores, RT is negatively predicted by mean rank, βs < -.05, ps < .01, and by number of ranks apart, βs < -.05, ps < .001, indicating that as the value, and the difference in value, of foundations in a choice increases, time to make the choice decreases. However, as in Study 1, there was no evidence of an interaction between these for ranks based on either MFQ or MFCT scores, βs < |.004|, ps > .10. There were no main effects of condition, βs = .04, ps > .10.

There was a marginal interaction between condition and ranks apart on the MFCT, β = .03, $p < .10$, but this is a small effect (see Figure 6.10 and Figure 6.11).

Table 6.9. Predicting RT from condition, mean rank, and ranks apart on the MFQ and MFCT for Study 2

	Models	
	log RT	
	MFQ	MFCT
Fixed effects		
Intercept	-.02 (.08)	-.02 (.08)
Condition (Load v. Control)	.04 (.11)	.04 (.11)
Mean Rank	-.05** (.02)	-.08*** (.02)
Ranks Apart	-.05*** (.01)	-.07*** (.01)
Condition : Mean Rank	.001 (.02)	-.004 (.02)
Condition : Ranks Apart	.02 (.02)	.03† (.02)
Mean Rank : Ranks Apart	.01 (.02)	-.02 (.02)
Condition : Mean Rank : Ranks Apart	.04 (.02)	.01 (.03)
Random effects		
By Subject - σ		
Intercept	.55	.55
Foundation Combination	< .001	< .001
Valence	< .001	< .001
Action	.34	.33
Residual	.76	.76
Marginal R^2 / Conditional R^2	.01 / .43	.01 / .42
LogLik	-19,431	-19,414
AIC	38,887	38,855
BIC	38,987	38,955

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 15,829. Fixed and random effects for separate models predicting log RT. Outcome variables and predictors have been standardised. Mean rank calculated as *mean*($Rank_1$, $Rank_2$), of reversed ranks, such that higher mean rank indicates more valued foundations. For condition: control is the reference level. For fixed effects, *SE* is provided in parentheses.

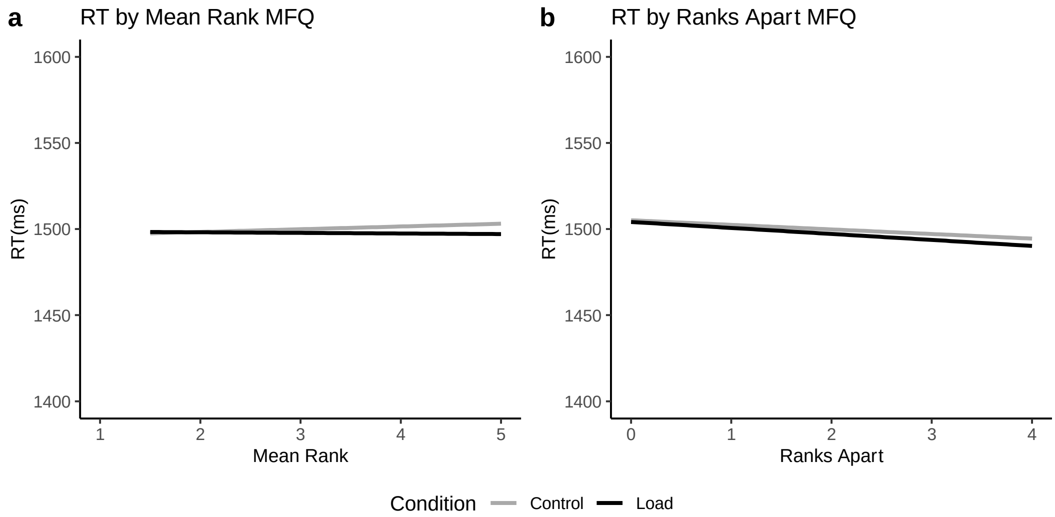

Figure 6.10. Condition and (a) mean rank and (b) ranks apart on MFQ predicting RT for Study 2. Grey areas represent 95% CI boundaries.

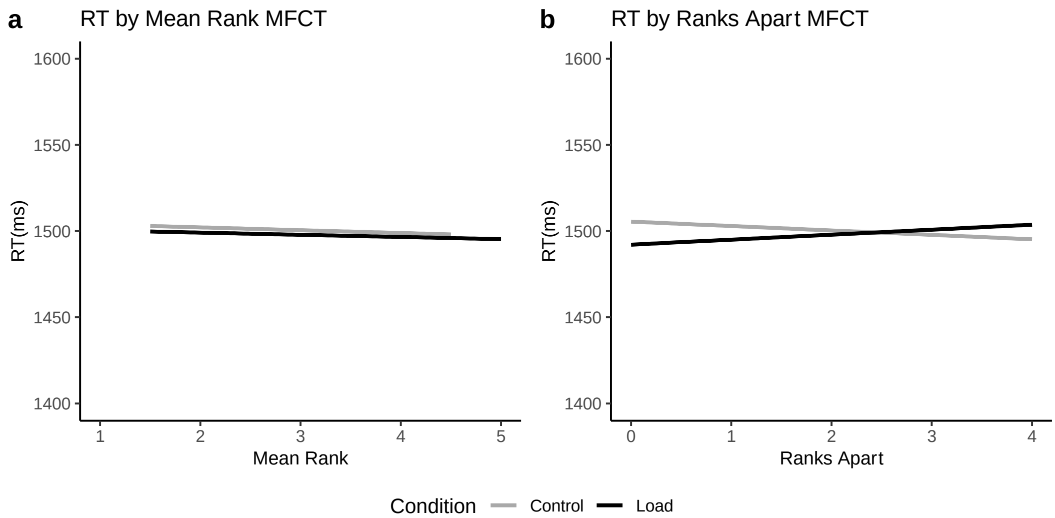

Figure 6.11. Condition and (a) mean rank and (b) ranks apart on MFCT predicting RT for Study 2. Grey areas represent 95% CI boundaries.

Tone-Counting Performance

Participants heard around 20 high tones per block, and tended to miscount tones, M = 2.77, SD = 1.41, with around 35% making errors of 5 or more in at least one block. There was a difference in accuracy between vice, M = 3.35, SD = 2.52, and virtue blocks, M = 2.18, SD = 2.18, $t(97) = -3.47$, $p < .001$, d = .35, but no evident difference between active, $M = 2.72$, $SD = 2.66$, and passive blocks, $M = 2.81$, $SD = 2.18$, $t(97) = .28$, $p = .78$.

On completion of the MFCT, participants in the load condition were asked to evaluate the difficulty and accuracy of concurrently completing the MFCT and the tone-counting exercise (see Table 6.10). On 1 to 10 scales, participants reported middling accuracy on counting the tones, $M = 5.67$, $SD = 1.93$, and felt that this had interfered with their ability to make choices on the MFCT, $M = 7.73$, $SD = 1.25$. These perceptions about performance did not correlate with actual performance on the tone-counting task, indicated by the number of errors made. Participants also generally found the joint task to be difficult, $M = 6.76$, $SD = 1.73$, but felt responses given on the MFCT were reflective of their beliefs and values, $M = 7.14$, $SD = 1.50$.

In separate models predicting number of tone-count errors, there was a marginally significant effect of perceived accuracy, $\beta = -.27$, $p < .10$ (see Table 6.11), suggesting that participants tended to correctly assess their accuracy on the task. However, no other perceived aspects of performance predicted the number of errors actually made, $\beta s < |.17|$, $ps > .10$. Furthermore, the perceived extent to which responses on the MFCT reflected participants beliefs/values did not predict actual correlations between the MFCT and the MFQ, $\beta = -.05$, $p > .10$ (see Table 6.11).

Table 6.10. Descriptive statistics and Pearson correlations for tone count variables in Study 2

	M	*SD*	1	2	3	4
1. How difficult did you find the decision making task?	6.76	1.73				
2. How much did having to count the tones interfere with your ability to choose between the words or phrases?	7.73	1.25	.35†			
3. How accurate do you think you were in the counting tones?	5.67	1.93	-.20	-.17		
4. How much do you think your responses on the decision making task reflected your beliefs/values?	7.14	1.50	-.41*	-.06	.48**	
5. Error in tone count	2.77	1.41	.12	.12	-.27	-.17

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Questions 1 – 4 are on a 1 to 10 scale. Error in tone count is the difference between the number of high tones heard and the number of tones reported by participants. p-values corrected for multiple comparisons (Bonferroni).

Table 6.11. Predicting performance in tone-counting task in Study 2

	Models				
	Error in tone count				Correlation - MFQ and MFCT
Fixed effects					
Intercept	-.00 (.14)	-.00 (.14)	.00 (.14)	-.00 (.14)	-.00 (.14)
1. How difficult did you find the decision making task?	.12 (.14)				
2. How much did having to count the tones interfere with your ability to choose between the words or phrases?		.12 (.14)			
3. How accurate do you think you were in the counting tones?			-.27† (.14)		
4. How much do you think your responses on the decision making task reflected your beliefs/values?				-.17 (.14)	-.05 (.15)
R^2	.02	.01	.07	.03	.002
Adj. R^2	-.01	-.01	.05	.01	-.02
Resid. *SE*	1.00	1.00	.97	1.00	1.01
F Statistic (1, 47)	.73	.66	3.71†	1.38	.11

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 49. Separate models predicting error in tone counting tasks and correlation between the MFQ and the MFCT. Variables have been standardised. *SE* is provided in parentheses.

Together, this suggests that while participants subjectively found doing both tasks together difficult, they also felt that their responses on the MFCT reflected their values. Participants generally performed poorly on the tone-counting task, with 17 (35%) off the correct count by more than five tones for at least one block, and were, to an extent, aware of this poor tone-counting performance.

6.1.3 Discussion

If trade-offs in the MFCT are mostly the result of deliberated cognitive work, then increasing cognitive load should interfere with these processes and thus alter responses, affecting the correlation between the MFCT and the MFQ. We did not find support for this – there was no evidence of consistent effects of condition in our analyses. In particular, the correlation between the two measures did not significantly differ in the divided attention condition, suggesting that increased cognitive load did not affect responses on the MFCT. This was further supported by a Bayes factor indicating moderate evidence for this null hypothesis.

There are several possible explanations for no effect of condition. First, it may be the case that completing both tasks concurrently – the MFCT and the tone-counting task – was too difficult, and the emphasis placed on providing gut reactions on the MFCT meant that participants neglected the tone-counting task in favour of the MFCT, and thus may not have been sufficiently dividing their attention. The fact that participants gave high difficulty ratings in the divided attention condition and were notably inaccurate in counting tones may support this explanation. Thus, though the tone-counting task has been previously applied to effectively divide attention (Skitka et al., 2002), it may be that its application here did not work.

An alternative explanation is that the divided attention manipulation did not affect response patterns because responses on the MFCT do not necessitate cognitive effort. Specifically, that participants are making responses based on their fast, intuitive moral intuitions, and thus the MFCT is indeed an effective measure of *implicit* foundation endorsement. To tease these explanations apart, an alternative cognitive load manipulation is applied in Study 3.

Similar to Study 1, we found that, collapsed across condition, foundation rankings measured on the MFQ and emerging from the MFCT correlated at r_{τ} (99) = .56. We also broadly replicated response time analyses, finding that differences in both MFQ and MFCT scores predicted response times, such that a greater difference was associated with faster reaction time, although again these effects are weak. Modelling RT and Ex-Gaussian parameters based on ranks apart on participants' rank orderings, we replicated predicted effects, such that response time and τ, isolating conflict in decision-making, decreased with increasing ranks apart. However, as in Study 1, models of RT leave a large proportions of variance unexplained, and effects are relatively weak. Further exploration of RT on the MFCT will benefit from larger sample sizes, a limitation addressed in Study 5.

Overall, these replications support an argument that the MFCT is reliably measuring foundation endorsement.

6.2 Study 3

Study 3 aims to apply an alternate cognitive load manipulation, alcohol, to examine whether the response patterns on the MFCT are affected by availability of cognitive resources, with a load manipulation that is less vulnerable to poor participant performance. Data for this study was collected in conjunction with Kunders (2017), and analysed and submitted independently for a masters thesis.

As in Study 2, we are interested in whether the relationship between the intuitive responses on the MFCT and explicit responses on the MFQ would be affected by increasing cognitive load during the MFCT. Specifically, if responses on the MFCT are merely noisy and fast deliberated judgments, we would expect that increasing cognitive load would reduce the correlation between MFCT and MFQ scores. We would also expect greater conflict under cognitive load as unsuppressed intuitions clash, indicated by longer response times, and greater τ values.

However, rather than using a concurrent task to divide attention, we administered a dosage of alcohol. Several prior studies on social cognitive processes have used alcohol as a manipulation that inhibits deliberative processing, leaving automatic thought largely unaffected, including work on the control of prejudice-related responses (Bartholow, Dickter, & Sestir, 2006) and automatic preferences for hierarchy (Van Berkel et al., 2015). Load participants were given an alcohol dosage before completing the MFCT, calculated to raise blood alcohol content (BAC) to a level at which attention and judgment begins to diminish. This level is based on classifications of the symptoms caused by ethanol's effects on the central nervous system into stages of influence that correlate with overlapping ranges of BAC (Dubowski, 1980). By using this alternative manipulation of attention, we aim to address the limitations to Study 2 that we may have found no effects of condition because participants were performing the concurrent task poorly and therefore not sufficiently dividing their attention.

6.2.1 Method

Participants

Sample size was identified on a similar basis as Study 2. Ninety participants were recruited through university networks across two concurrent recruitment drives, one of which indicated that participation would require the consumption of alcohol, therefore determining whether participants would participate in either the control or alcohol condition. We opted to recruit to condition as a means of managing ethical considerations around the consumption of alcohol in the lab that required participants in this condition to satisfy additional requirements and complete a separate consent form. Participants in the alcohol condition had to confirm that they met with requirements drawn from a previous study on the effects of alcohol on decision-making (Bregu, Deck, Ham, & Jahedi, 2017), which included having previous experience with, and no health conditions that precluded, the consumption of alcohol. The control and alcohol groups were compensated 3 GBP and 5.50 GBP respectively to reflect the time required to complete participation. All participants were required to be fluent English speakers.

Figure 6.12 shows a histogram of the distribution of RTs. A total of sixty-one trials (<.01%) were removed across 9 subjects as they did not meet the RT criteria applied for Study 1 and 2. One subject was removed because more than 10% of their trials were eliminated, leaving a total of 14,224 trials ($M_{RT\ Control}$ = 2187ms; $SD_{RT\ Control}$ = 1238ms; $M_{RT\ Alcohol}$ = 2421ms; $SD_{RT\ Alcohol}$ = 1364ms). The final sample comprised 89 participants (64% females, M_{age} = 23.76; SD = 4.53), with 43 participants in the control condition, and 46 in the alcohol condition.

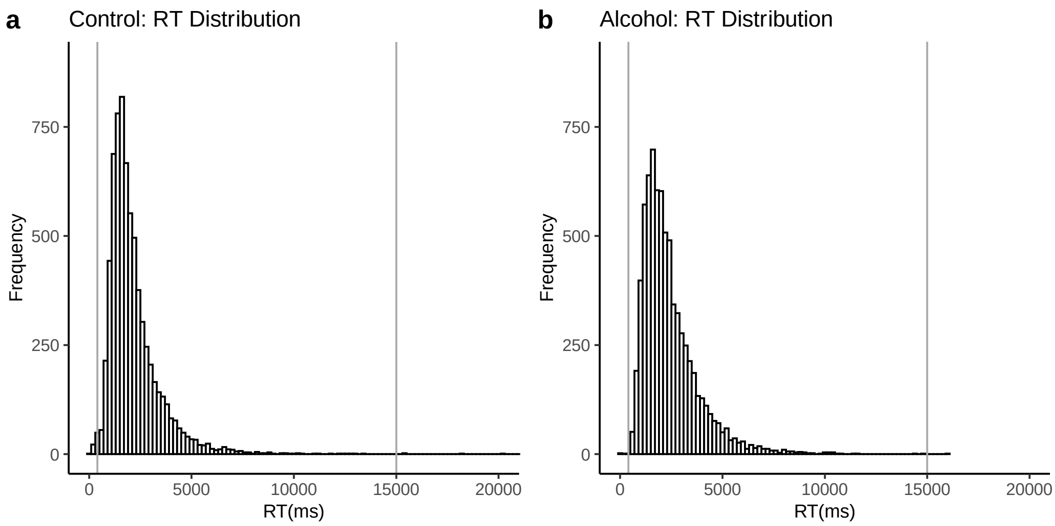

Figure 6.12. Distribution of RTs across all trials in Study 3. Grey reference lines indicate cut-off points of 400ms and 15,000ms.

Measures and Procedure

As in Study 1 and 2, all participants completed the MFQ and MFCT. However, unlike the previous studies, the MFQ was completed online, up to one week before participants arrived at the lab. Subscale reliabilities on the MFQ were judged to be acceptable for all foundations in Study 3 (αs: care = .77; fairness = .73; authority = .72; loyalty = .73; purity = .83) with alphas for care and fairness being notably higher than in Study 1 (αs: care = .38; fairness = .55; authority = .63; loyalty = .71; purity = .79) and Study 2 (αs: care = .58; fairness = .55; authority = .67; loyalty = .68; purity = .79). The MFCT was completed in a lab setting.

Alcohol condition

Participants in the alcohol condition were required to complete additional questions online, which included specifying how often they consumed alcohol (Once a month or less / 2 to 4 times a month / 2 to 3 times a week / Four or more times a week), and how much they consumed per week (One to 14 units / 14 to 20 units / More than 20 units). In addition, alcohol participants were asked to provide their bodyweight in kilograms for dosage calculations.

Alcohol doses comprised 1 part vodka to 3 parts mixer (lemonade). Doses were calculated to achieve .03 BAC, a level at which attention and judgment begins to diminish (Dubowski, 1980). Doses were calculated for each participant based on bodyweight, with a dose of .20g/kg for female and .25g/kg for male participants. The vodka used contained 7.41g of alcohol in every 25ml (1 unit), and participants consumed an average of 42.78ml (females) and 66.41ml (males) of vodka.

Alcohol doses were consumed on arrival at the lab, and were followed by a 20 minute period to allow the alcohol to take effect. Participants were then asked to complete the MFCT.

6.2.2 Results

For Study 3, we replicate analyses for Study 1 and 2, separating analyses into three main sections, first assessing the effects of the structure of the MFCT, before exploring correlations between the MFCT and MFQ, and RTs on the MFCT as indicators of conflict in decisions between foundations. To address hypotheses for Study 3, we replicate the approach applied in Study 2, examining differences in correlations and RT across conditions. Finally, we consider participants' alcohol consumption habits in the alcohol condition.

Results from analyses pertaining to the properties of items and block structure were consistent with those in previous studies. Similar to Study 2, we did not find any evidence of consistent effects of condition across analyses, including no evidence for a difference between conditions in the correlation between the MFQ and MFCT.

Structure of MFCT

We largely replicated previous effects of item valence score and length, and interpret them similarly (see Appendix 2).

Effect of blocks

Analyses assessed whether condition and blocks on the MFCT had any effect on responses and RT patterns. As in Study 2, there was no main effect for condition, β = -.001, p > .10, nor any significant interactions between condition, valence, or action, βs < |.002|, p > .10, on MFCT scores. Contrary to Study 2, there was a main effect of condition on RT, β = .25, p < .05, with longer RTs in the alcohol condition, and an interaction between condition and valence on RT, β = -.11, p < .01, with a larger difference in RTs between vice and virtue blocks in the alcohol condition. There was no evidence of an interaction for RT between condition and action, β = -.03, p > .10.

There was a larger difference in choosing between individuating and binding foundations, β = -.42, p < .05, and marginally between care and fairness, β = -.21, p < .10, in the alcohol condition. Other interactions between condition and foundation were not significant, βs < .17, ps > .10, as were all other interactions including condition, βs < |.40|, ps > .10.

As in Study 1 and 2, neither the valence, nor the action formulation of items, nor the interaction between valence and action had an evident effect on MFCT scores. However, the interaction between valence and action did affect RT, β = -.30, p = < .001.with passive items being faster in the virtue block.

Also as in Study 1 and 2, there was a significant effect of foundation on MFCT scores, with binding foundations being chosen less, β = -.85, p < .001, and slower, β =

.21, $p < .001$, than individualising foundations. As in previous studies, this likely reflects that, as students, most participants were likely to be liberal, prioritising individualising foundations. Further significant interactions between valence, action, and foundation can be seen in Table 6.12, Figure 6.13 and Figure 6.14.

Table 6.12. MFCT score and RT by condition, blocks, and foundation for Study 3

	Models	
	MFCT Score	log RT
Fixed effects		
Intercept	-.002 (.05)	.16* (.08)
Condition (Alcohol v. Control)	-.001 (.07)	.25* (.11)
Valence (Virtue v. Vice)	-.001 (.08)	-.03 (.03)
Action (Passive v. Active)	-.00 (.08)	-.28*** (.03)
Foundation		
Binding v. Individualising	-.85*** (.13)	.21*** (.05)
Fairness v. Care	-.30*** (.09)	.15*** (.03)
Loyalty v. Authority	.25* (.10)	-.13*** (.04)
Purity v. Authority	-.46*** (.10)	.16*** (.04)
Condition : Valence	.001 (.11)	-.11** (.04)
Condition : Action	-.00 (.11)	-.03 (.04)
Valence : Action	.002 (.11)	-.30*** (.04)
Condition : Foundation		
Condition : Binding v. Individualising	-.42* (.18)	.10 (.07)
Condition : Fairness v. Care	-.21† (.12)	.05 (.04)
Condition : Loyalty v. Authority	.17 (.14)	.08 (.05)
Condition : Purity v. Authority	.09 (.14)	-.07 (.06)
Valence : Foundation		
Valence : Binding v. Individualising	-.38* (.19)	.01 (.07)
Valence : Fairness v. Care	.60*** (.12)	-.12** (.04)
Valence : Loyalty v. Authority	.21 (.14)	.15** (.05)
Valence : Purity v. Authority	.53*** (.14)	-.20*** (.06)
Action : Foundation		
Action : Binding v. Individualising	-.48* (.19)	.06 (.07)
Action : Fairness v. Care	-.11 (.12)	-.04 (.04)
Action : Loyalty v. Authority	.10 (.14)	.13* (.05)
Action : Purity v. Authority	.23† (.14)	-.20** (.06)

Condition : Valence : Action	< .001 (.15)	.06 (.06)
Condition : Valence : Foundation		
Condition : Valence : Binding v. Individualising	.13 (.26)	-.13 (.10)
Condition : Valence : Fairness v. Care	.14 (.17)	-.06 (.05)
Condition : Valence : Loyalty v. Authority	-.28 (.19)	-.02 (.08)
Condition : Valence : Purity v. Authority	-.00 (.19)	.07 (.08)
Condition : Action : Foundation		
Condition : Action : Binding v. Individualising	.19 (.26)	-.05 (.10)
Condition : Action : Fairness v. Care	.24 (.17)	-.04 (.05)
Condition : Action : Loyalty v. Authority	-.21 (.19)	-.08 (.08)
Condition : Action : Purity v. Authority	-.03 (.19)	.06 (.09)
Valence : Action : Foundation		
Valence : Action : Binding v. Individualising	.75** (.27)	-.25** (.10)
Valence : Action : Fairness v. Care	-.15 (.17)	.01 (.06)
Valence : Action : Loyalty v. Authority	-.88*** (.20)	-.18* (.08)
Valence : Action : Purity v. Authority	-.61** (.20)	.29*** (.08)
Condition : Valence : Action : Foundation		
Condition : Valence : Action : Binding v. Individualising	-.18 (.37)	.07 (.14)
Condition : Valence : Action : Fairness v. Care	-.25 (.24)	.03 (.08)
Condition : Valence : Action : Loyalty v. Authority	.40 (.27)	.04 (.11)
Condition : Valence : Action : Purity v. Authority	-.24 (.27)	-.15 (.12)
Random effects		
By Subject - σ		
Intercept	< .001	.50
Residual	.78	.82
Marginal R^2 / Conditional R^2	.39 / .39	.08 / .33
LogLik	-2,087	-17,538
AIC	4,258	35,161
BIC	4,488	35,478

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 1,780 (MFCT Score) and 14,224 (log RT). Fixed and random effects for separate models predicting MFCT score and log RT. Outcome variables have been standardised. For RT model, foundation represents the foundation of the item chosen in a given trial. Planned contrasts for foundation compare individualising to binding foundations (with the former as the reference level), and then compare Care to Fairness (former as reference level), and Authority to Loyalty and Purity (Authority as reference level). For condition, valence and action: control, vice and active are reference levels. For fixed effects, *SE* is provided in parentheses.

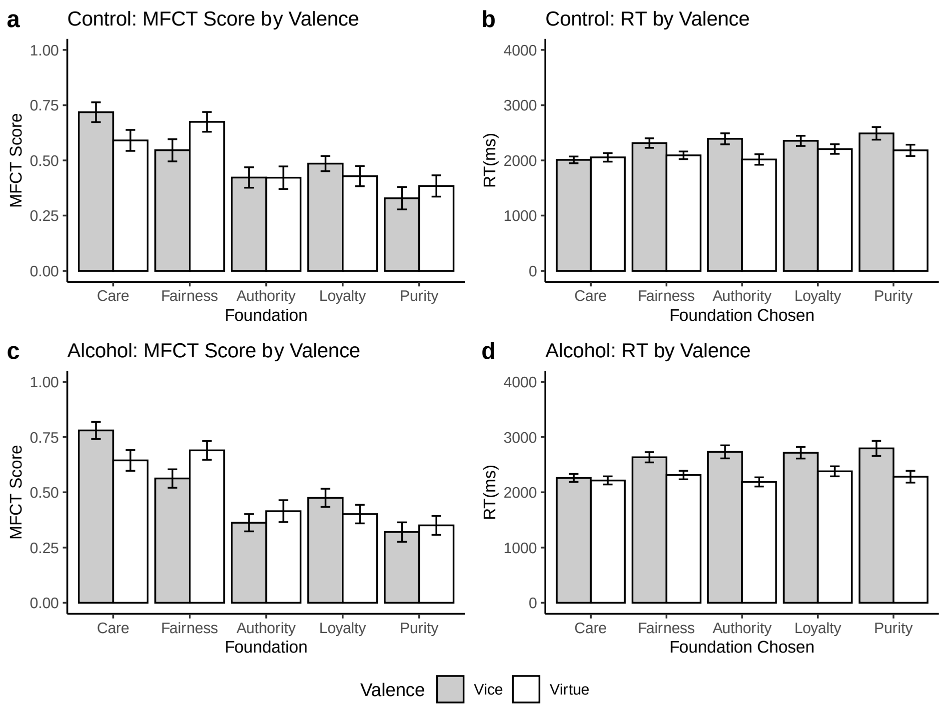

Figure 6.13. MFCT score (a, c) and RT (b, d) for control (a, b) and alcohol (c, d) conditions by valence block and foundation in Study 3. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

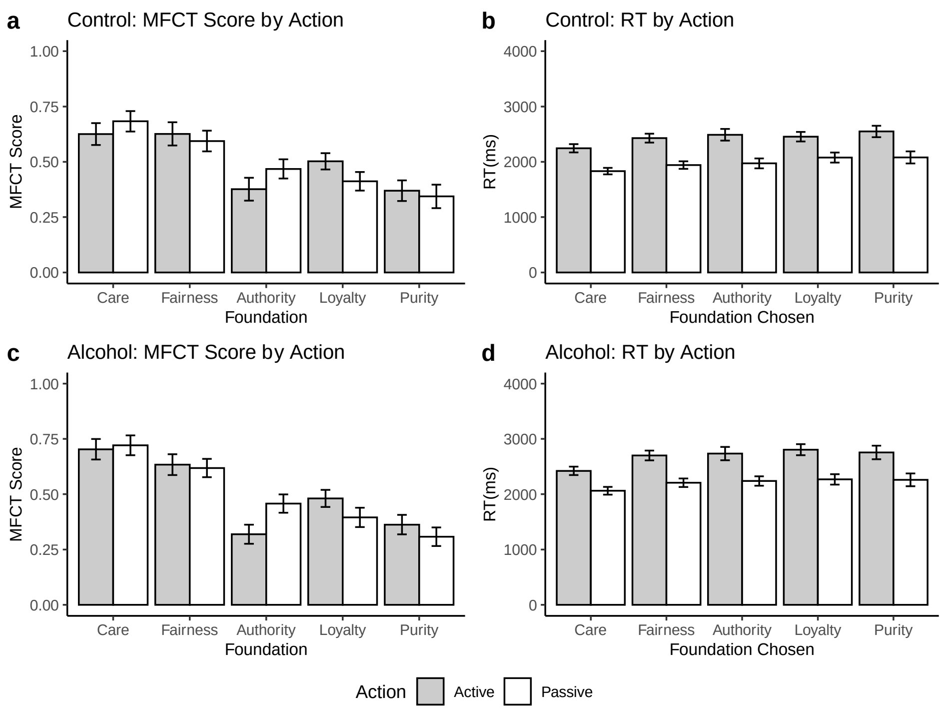

Figure 6.14. MFCT score (a, c) and RT (b, d) for control (a, b) and alcohol (c, d) conditions by action block and foundation in Study 3. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

Within-subject mean RTs and Ex-Gaussian parameters were fit for each block (see Table 6.13 and Figure 6.15). Contrary to Study 2, there were significant effects of condition on mean RT, $\beta = .42$, $p < .05$, and marginally on τ, $\beta = .37$, $p < .10$, but not on μ, $\beta = .13$, $p > .10$. RTs were longer in the alcohol condition, with greater τ, and thus increased conflict, that is not reflected in processing speed, or μ. There was an interaction between condition and valence on τ, $\beta = -.42$, $p < .05$, with a larger difference between choices on vice and virtue trials in the alcohol condition. All other interactions with condition were not significant, βs = |.38|, ps > .10.

The interaction between valence and action again predicted mean RT, $\beta = -.46$, $p < .001$, and marginally for μ, $\beta = -.33$, $p < .10$, indicating faster processing speed for passive virtue items. As in Study 1, but contrary to Study 2, this interaction was not significant for τ, $\beta = -.29$, $p > .10$.

Table 6.13. RT, μ and τ by condition and blocks for Study 3

	Models		
	log RT	log μ	log τ
Fixed effects			
Intercept	.16 (.14)	.25† (.14)	-.05 (.15)
Condition (Alcohol v. Control)	.42* (.20)	.13 (.20)	.37† (.21)
Valence (Virtue v. Vice)	-.02 (.09)	-.05 (.14)	.09 (.13)
Action (Passive v. Active)	-.42*** (.09)	-.43** (.14)	-.08 (.13)
Condition : Valence	-.17 (.12)	.17 (.19)	-.42* (.18)
Condition : Action	-.04 (.12)	-.10 (.19)	-.04 (.18)
Valence : Action	-.46*** (.12)	-.33† (.20)	-.29 (.18)
Condition : Valence : Action	.10 (.17)	-.09 (.27)	.38 (.25)
Random effects			
By Subject - σ			
Intercept	.82	.68	.79
Residual	.40	.64	.59
Marginal R^2 / Conditional R^2	.17 / .84	.14 / .60	.03 / .65
LogLik	-305	-420	-410
AIC	630	860	840
BIC	669	899	879

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 356. Fixed and random effects for separate models predicting log RT, μ and τ. Outcome variables have been standardised.

For condition, valence and action: control, vice and active are reference levels. For fixed effects, *SE* is provided in parentheses.

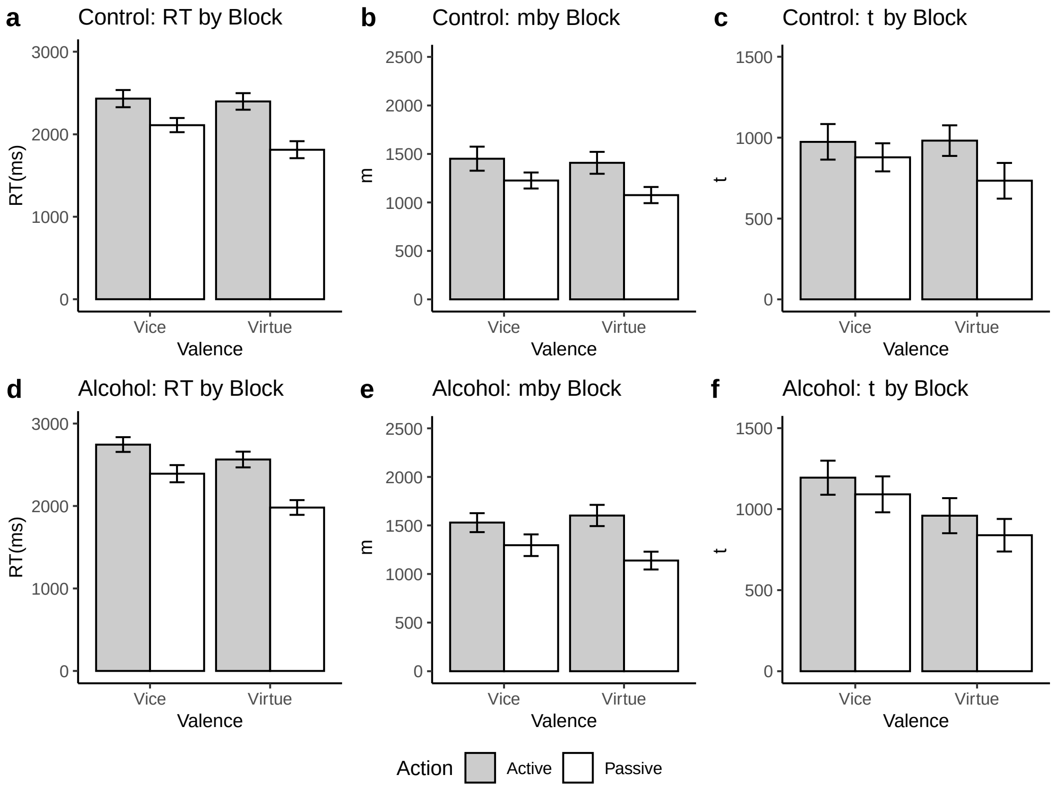

Figure 6.15. Mean RT (a, d), μ (b, e) and τ (c, f) for control (a-c) and alcohol (d-f) by blocks. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

Consistent with Study 1 and 2, these analyses indicate that the block structure of the task impacts response patterns and RTs on the MFCT. For RT, it is quicker and easier to make choices between virtue and passive items. In contrast with Study 2, there were significant effects of condition on RT, with slower response, and some greater differences between blocks, in the alcohol condition. This can be interpreted as an indication of the success of the alcohol condition as a manipulation of cognitive load, as we would expect this to slow responses.

As in Study 1 and 2, we assessed internal reliability of the full MFCT and for each block, collapsing across conditions. Table 6.14 shows split-half reliability coefficients. Reliability is acceptable for the full task, and across blocks.

Table 6.14. Bootstrapped split-half reliability across blocks for Study 3

	r_{Boot}	Bias	95% CI of r	$SE\ r_{Boot}$
Study 3 (N = 89)				
Full Task	.82	.01	[.77 , .85]	.02
Vice	.81	.00	[.77 , .86]	.02
Virtue	.71	.06	[.58 , .72]	.04
Active	.74	.07	[.61 , .72]	.03
Passive	.83	-.04	[.81 , .93]	.03

Note. Bootstrapped with 5,000 iterations.

Correlating MFQ and MFCT Scores

Mean responses and correlations across foundations are shown in Table 6.15. Correlations for all foundations were significant: care, r = .58, p <. 001, fairness, r = .38, p < .01, authority, r = .52, p < .001, loyalty, r = .36, p < .01, and purity, r = .59, p < .001.

Table 6.15. Descriptive statistics and Pearson correlations for Study 3 variables

	M	SD	1	2	3	4	5	6	7	8	9
1. Care-MFQ	3.69	.79	-								
2. Fairness-MFQ	3.82	.66	$.51^{***}$	-							
3. Authority-MFQ	2.33	.79	-.03	-.22	-						
4. Loyalty-MFQ	2.38	.83	-.04	-.13	$.65^{***}$	-					
5. Purity-MFQ	1.68	1.02	.16	-.18	$.63^{***}$	$.66^{***}$	-				
6. Care-MFCT	.68	.15	**$.58^{***}$**	.26	$-.30^{*}$	$-.33^{*}$	-.23	-			
7. Fairness-MFCT	.62	.15	-.07	**$.38^{**}$**	$-.48^{***}$	$-.47^{***}$	$-.59^{***}$	.16	-		
8. Authority-MFCT	.40	.12	$-.33^{*}$	-.21	**$.52^{***}$**	.23	.17	$-.41^{***}$	$-.31^{*}$	-	
9. Loyalty-MFCT	.45	.12	-.26	-.21	.08	**$.36^{**}$**	.11	$-.48^{***}$	$-.43^{***}$	.00	-
10. Purity-MFCT	.35	.15	-.03	$-.29^{*}$	$.29^{\dagger}$	$.32^{*}$	**$.59^{***}$**	$-.42^{***}$	$-.55^{***}$	-.10	.08

Note. † p < .10, * p < .05, ** p < .01, *** p < .001. MFQ scores are on a 0 to 5 scale, MFCT scores are on a 0 to 1 scale. p-values corrected for multiple comparisons (Bonferroni). Correlations between the same foundations on the MFQ and on the MFCT have been highlighted in bold.

Kendall rank correlation coefficients between MFCT to MFQ responses, calculated for each participant, ranged from -.32 to 1.00, with a mean of r_{τ} (89) = .61. To assess stability, this estimate was bootstrapped to give an estimate of $r_{\tau Boot}$ = .64 (*SE* $r_{\tau Boot}$ = .03, *95% CI* [.60, .74]). As in Study 2, there was no evidence for a difference between correlations in the control, r_{τ} (43) = .56, and alcohol conditions, r_{τ} (46) = .65, *95% CI* [-.25, .06] (see Table 6.16).

As in Study 2, given this comparison is a crucial test of our hypotheses, we conducted further analysis to interpret non-significance conducting a non-parametric Mann–Whitney U test with a Bayes factor. Following van Doorn et al. (2020), we confirmed non-significance, *U* = 886.00, *Z* = -.85, *p* = .40, *r* = .09, and calculated a BF_{10} of .38, interpreted as weak evidence for the null hypothesis applying conventional cut-offs (Jeffreys, 1939/1961; Lee & Wagenmakers, 2014).

Table 6.16. Correlations between MFQ and MFCT scores across conditions for Study 3

	Sample r_{τ}	$r_{\tau Boot}$	Bias	95% CI of r_{τ}	*SE* $r_{\tau Boot}$	95% CI of Difference
Control (*N* = 43)	.56	.56	.010	[.43, .65]	.054	[-.25 , .06]
Alcohol (*N* = 46)	.65	.64	.010	[.56, .71]	.038	

Note. Bootstrapped with 5,000 iterations. CIs are the Bias Corrected Accelerated (BCa) intervals

Also, as in Study 1 and 2, there was no evident difference in correlations between vice and virtue blocks, *95% CI* [-.19, .04], nor between the active and passive blocks, *95% CI* [-.12, .10], with CIs that include 0 indicating non-significant difference between correlations (see Table 6.17).

Table 6.17. Correlations between MFQ and MFCT scores across blocks for Study 3

	Sample r_{τ}	$r_{\tau Boot}$	Bias	95% CI of r_{τ}	*SE* $r_{\tau Boot}$	95% CI of Difference
Study 3 (*N* = 89)						
Full Task	.61	.64	-.027	[.60, .74]	.031	
Vice	.49	.45	.042	[.34, .47]	.035	[-.19 , .04]
Virtue	.56	.56	-.010	[.50, .63]	.035	
Active	.53	.54	-.010	[.47, .61]	.035	[-.12 , .10]
Passive	.54	.50	.034	[.41, .54]	.035	

Note. Bootstrapped with 5,000 iterations. CIs are the Bias Corrected Accelerated (BCa) intervals

Replicating a correlation of similar magnitude from Study 1 and 2, these results indicate a 61% match between the order, or ranks, of foundation endorsement measured by the MFQ and foundation preference expressed in the MFCT, stable across all blocks of the task. Furthermore, and consistent with results from Study 2, the correlation between MFCT scores and MFQ scores was not lower in the alcohol condition and there was no significant difference between conditions.

Predicting RT on the MFCT

Exploratory analyses conducted in Study 1 and 2 were replicated to explore RT as an indicator of conflict. As in Study 2, condition was included as a predictor to test predictions that there will be greater conflict in the alcohol condition, apparent in longer RTs, and greater τ values.

Difference in foundation scores predicting RT

As in previous studies, separate multilevel models (see Table 6.18) were fit to predict RT from the difference between MFQ and MFCT scores, entered into the models as linear (x) and quadratic (x_2) terms, predicting that RT will be highest when the difference is 0 and two foundations are equally valued, and that this effect would be non-linear. Figure 6.16 plots these quadratic regressions.

Contrary to Studies 1 and 2, though the linear and quadratic terms in both models were in the predicted direction, they were not significant, βs < |.07|, ps > .10. As in Study 2, there were no significant effects of condition, nor any interactions between condition and any other terms in the models, βs < |.18|, ps > .10.

Table 6.18. Predicting RT from condition and difference in MFQ and MFCT scores for Study 3

	Models	
	log RT	
Fixed effects		
Intercept	.003 (.08)	-.002 (.08)
Condition (Alcohol v. Control)	.15 (.11)	.18 (.12)
Difference in MFQ Scores	-.07 (.05)	
Difference in MFQ Scores^2	-.01 (.01)	
Condition : Difference in MFQ Scores	.05 (.06)	
Condition : Difference in MFQ Scores^2	-.004 (.02)	
Difference in MFCT Scores		-.04 (.04)

Difference in MFCT Scores^2		-.02 (.01)
Condition : Difference in MFCT Scores		.04 (.06)
Condition : Difference in MFCT Scores^2		-.01 (.02)
Random effects		
By Subject - σ		
Intercept	.50	.51
Foundation Combination	< .001	< .001
Valence	< .001	< .001
Action	.35	.34
Residual	.79	.79
Marginal R^2 / Conditional R^2	.02 / .39	.02 / .39
LogLik	-17,998	-17,979
AIC	36,018	35,981
BIC	36,102	36,064

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 14,224. Fixed and random effects for separate models predicting log RT. Outcome variables have been standardised. Quadratic models fit terms for difference in scores (x) and squared difference in scores (x^2) between foundations in a trial. In order to preserve a minimum value of 0 interpretable as no difference between scores for the quadratic term, difference predictors in these models were scaled by SD without centring. For condition: control is the reference level. For fixed effects, *SE* is provided in parentheses.

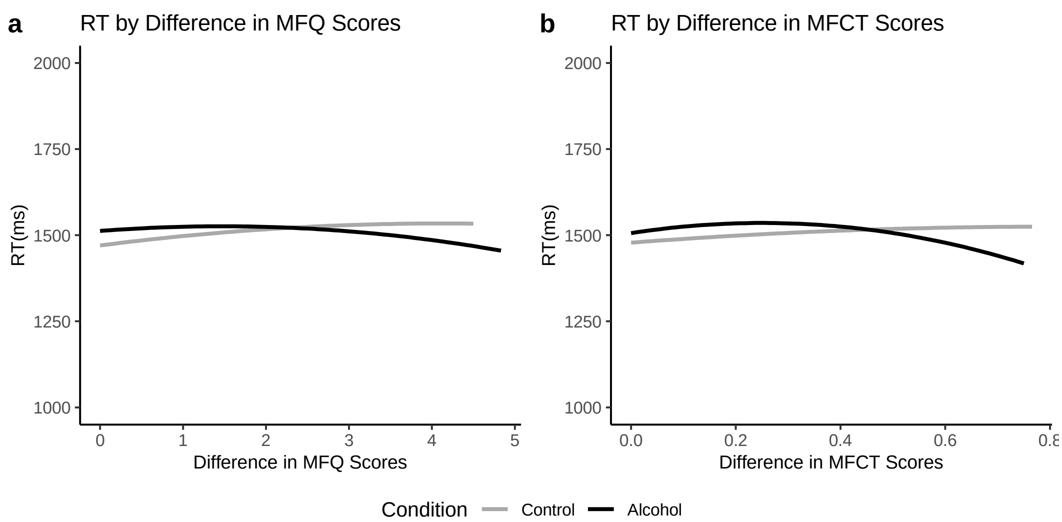

Figure 6.16. Predicting RT for Study 3 with quadratic models for (a) difference in MFQ scores and (b) difference in MFCT scores between foundations in a trial. Grey areas represent 95% CI boundaries.

Ranks apart predicting RT

Figure 6.17 and Figure 6.18 show histograms for within-subject mean RTs, μ and τ calculated for ranks apart categories in each condition based on the MFQ and MFCT, respectively.

As in previous studies, multilevel models were fit to predict RT, μ and τ from number of ranks apart, with a set of planned contrasts (Helmert coding) to test whether the former increases with fewer ranks apart. A total of 37 participants had equally scored foundations on the MFQ, and 14 on the MFCT, and as in Study 1 and 2, these were dropped from models.

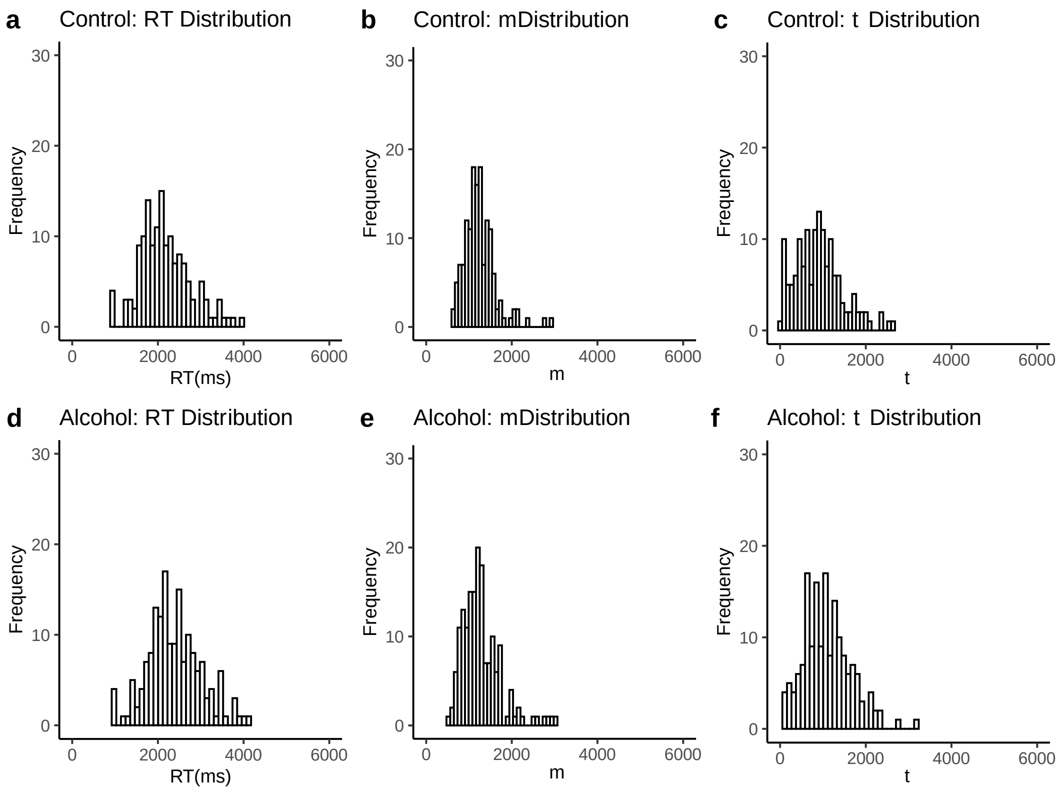

Figure 6.17. Distribution of RT (a), μ (b) and τ (c) across MFQ rank apart categories in Study 3

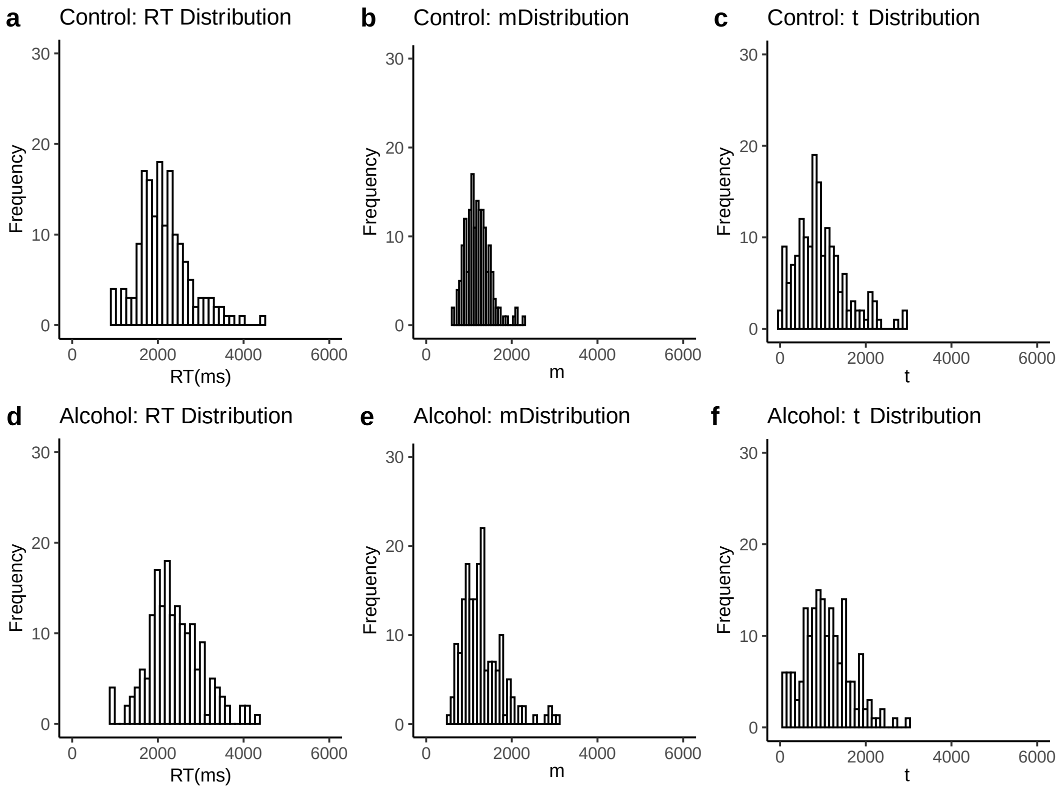

Figure 6.18. Distribution of RT (a), μ (b) and τ (c) across MFCT rank apart categories in Study 3

Ranks apart on MFQ

As in Study 1 and 2, a trend of decreasing RT and τ, as the number of ranks apart increases, can be seen in Figure 6.19 (panels a and c).

All comparisons were significant for mean RT, βs > .12*, p*s < .05, reflecting the downward trend as ranks apart increases (see Table 6.19). There was higher τ in one rank apart, β = .31, p < .01, and three ranks apart choices, β = .37, p < .05, relative to further apart choices, also suggesting a downward trend. This was not reflected in μ, βs < |.12|*, p*s > .10.

As in previous RT analyses, there were main effects of condition on mean RT, β = .40, p < .10, and τ , β = .41, p < .05, and an interaction for μ, β = .34*, p* < .05, that can be seen in Figure 6.19 (panel b), with a downward trend in the alcohol, but not the control condition. There were no other evident interactions between condition and ranks apart, βs < |.20|*, p*s > .10.

Ranks apart on MFCT

Contrary to Study 1 and 2, the expected decreasing trend in RT and τ is weaker when ranks apart based on the MFCT (see Figure 6.20), compared to when these are based on the MFQ. Mean RT is higher for one rank apart choices, $\beta = .18$, $p < .001$, and marginally for two rank choices, $\beta = .10$, $p < .10$. However there were no effects for τ, βs > .17, ps < .10, nor for μ, βs < |.06|, ps > .10.

There was a marginal main effects of condition, βs = .36, $p < .10$, for mean RT, but not for τ and μ, βs < .28, ps > .10, and no evidence of interactions between condition and rank apart for mean RT, τ, or μ, βs < |.26|, ps > .10.

Table 6.19. Predicting RT, μ and τ from condition and ranks apart on the MFQ and MFCT for Study 3

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	-.25† (.15)	-.04 (.13)	-.26* (.13)	-.19 (.14)	-.08 (.13)	-.14 (.13)
Condition (Alcohol v. Control)	.40† (.20)	.06 (.18)	.41* (.18)	.36† (.20)	.14 (.18)	.28 (.18)
Ranks Apart						
1 RA v. 2, 3, 4	.24*** (.05)	-.08 (.12)	.31** (.11)	.18*** (.05)	.06 (.11)	.14 (.11)
2 RA v. 3, 4	.12* (.06)	.08 (.14)	.10 (.13)	.10† (.06)	-.0002 (.12)	.17 (.12)
3 RA v. 4	.16* (.08)	.12 (.18)	.37* (.17)	.01 (.07)	.06 (.15)	.08 (.14)
Condition : Ranks Apart						
Condition : 1 RA v. 2, 3, 4	-.07 (.07)	.34* (.17)	-.20 (.16)	.01 (.07)	.19 (.16)	-.06 (.15)
Condition : 2 RA v. 3, 4	.11 (.08)	-.002 (.19)	.08 (.17)	.10 (.08)	.12 (.17)	-.19 (.16)
Condition : 3 RA v. 4	-.02 (.10)	-.19 (.24)	-.09 (.23)	.11 (.09)	-.26 (.20)	.16 (.20)
Random effects						
By Subject - σ						
Intercept	.93	.75	.77	.93	.76	.77
Residual	.28	.65	.61	.29	.62	.61
Marginal R^2 / Conditional R^2	.05 / .92	.01 / .57	.06 / .64	.04 / .91	.02 / .61	.03 / .62
LogLik	-207	-386	-370	-227	-407	-402
AIC	434	791	759	473	833	823
BIC	472	829	796	512	871	862

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 312 (MFQ) and 340 (MFCT). RA – Ranks Apart. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. Helmert coding compares each rank apart category to the mean of the subsequent categories. For condition: control is the reference level. For fixed effects, *SE* is provided in parentheses.

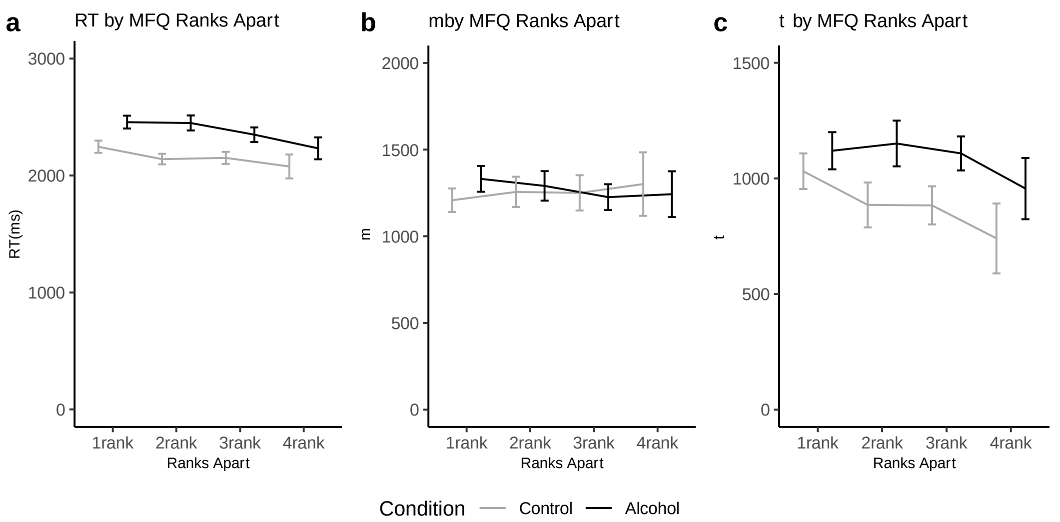

Figure 6.19. Condition and ranks apart on MFQ predicting RT (a), μ (b) and τ (c) for Study 3. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

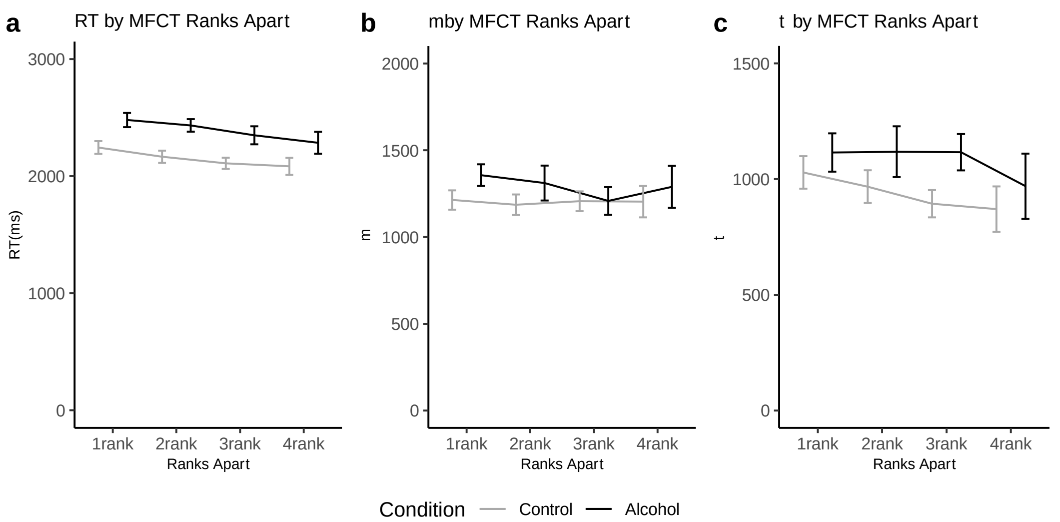

Figure 6.20. Condition and ranks apart on MFCT predicting RT (a), μ (b) and τ (c) for Study 3. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

These analyses broadly replicate the noisy patterns found for Study 1 and 2, suggesting that foundations endorsement/preference is reflected in RTs on the MFCT. However, these patterns were weaker when the number of ranks apart foundations in a choice were is based on the task itself, which is contrary to results in Study 2. Figure 6.19 and Figure 6.20 suggest higher τ in the alcohol condition, though this is only significant when ranks are based on the MFQ.

Weighted ranks apart predicting RT

As in Study 1 and 2, we implemented a number of analyses to weight choices between foundations by how much value is placed on them. As for Study 2, we report these analyses in full in Appendix 2 and include here models (see Table 6.20) implementing a bias term to weight number of ranks apart by the mean rank for foundations in a choice.

As in Study 1 and 2, for ranks based on both MFQ and MFCT scores, RT is negatively predicted by mean rank, βs < -.06, *p*s < .01, and by number of ranks apart, βs < -.05, *p*s < .001, indicating that as the value, and the difference in value, of foundations in a choice increases, time to make the choice decreases. However, as in Study 1 and 2, there was no evidence of an interaction between these for ranks based on either MFQ or MFCT scores, βs < |.01|, *p*s > .10.

There were marginal main effects of condition, βs > .18, *p*s < .10, and a small but significant three-way interaction between condition, mean rank, and ranks apart on the MFCT, β = -.05, *p* < .05 (see Figure 6.21 and Figure 6.22). No other interactions with condition were significant, βs < |.03|, *p*s > .10.

Table 6.20. Predicting RT from condition, mean rank, and ranks apart on the MFQ and MFCT for Study 3

	Models	
	log RT	
	MFQ	MFCT
Fixed effects		
Intercept	-.10 (.08)	-.10 (.08)
Condition (Alcohol v. Control)	.19† (.11)	.18† (.11)
Mean Rank	-.06** (.02)	-.07*** (.02)
Ranks Apart	-.06*** (.01)	-.05*** (.01)
Condition : Mean Rank	.01 (.02)	-.03 (.02)
Condition : Ranks Apart	.001 (.02)	-.02 (.02)
Mean Rank : Ranks Apart	-.003 (.02)	.01 (.02)
Condition : Mean Rank : Ranks Apart	.01 (.03)	-.05* (.03)

Random effects		
By Subject - σ		
Intercept	.49	.49
Foundation Combination	< .001	< .001
Valence	< .001	< .001
Action	.35	.34
Residual	.79	.80
Marginal R^2 / Conditional R^2	.01 / .38	.02 / .38
LogLik	-17,994	-17,969
AIC	36,014	35,964
BIC	36,113	36,062

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 14,224. Fixed and random effects for separate models predicting log RT. Outcome variables and predictors have been standardised. Mean rank calculated as *mean*($Rank_1$, $Rank_2$), of reversed ranks, such that higher mean rank indicates more valued foundations. For condition: control is the reference level. For fixed effects, *SE* is provided in parentheses.

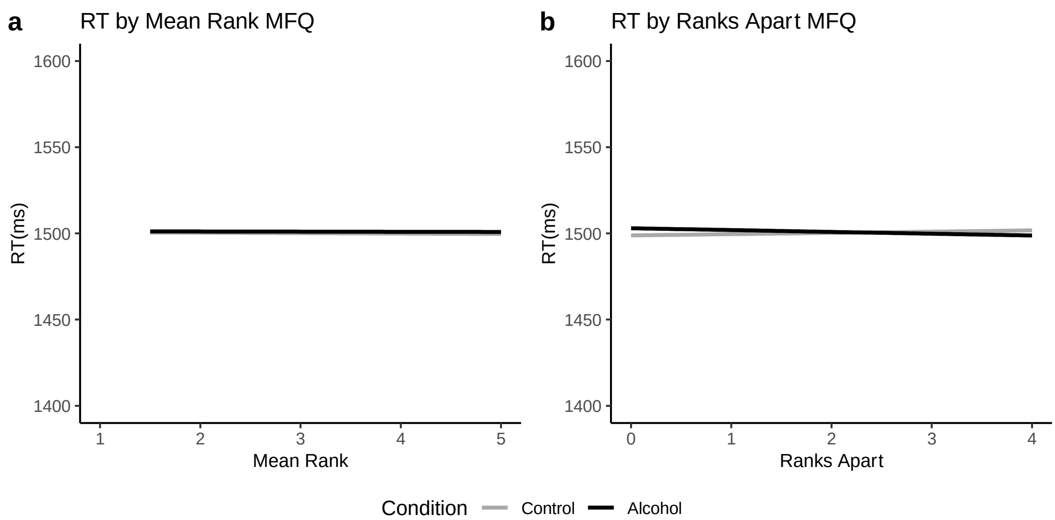

Figure 6.21. Condition and (a) mean rank and (b) ranks apart on MFQ predicting RT for Study 3. Grey areas represent 95% CI boundaries.

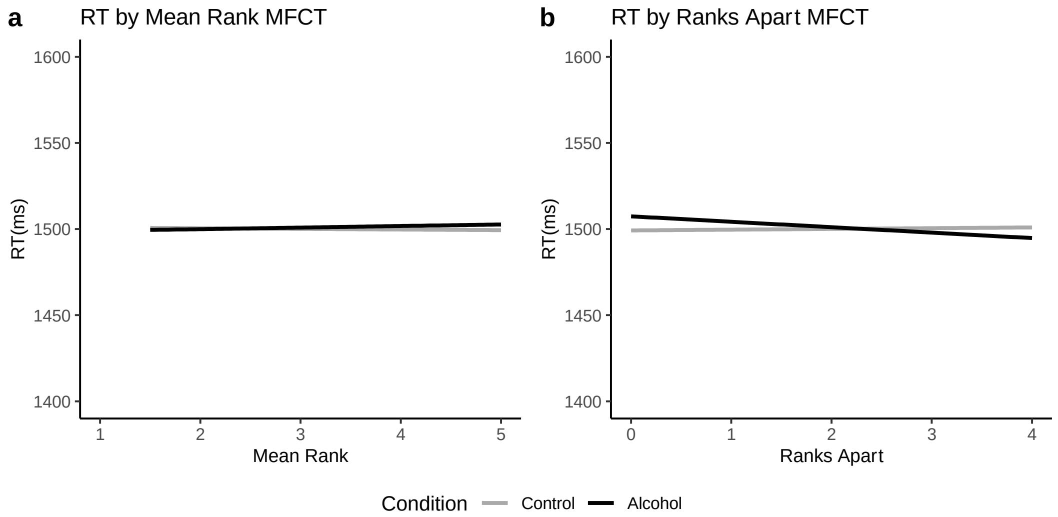

Figure 6.22. Condition and (a) mean rank and (b) ranks apart on MFCT predicting RT for Study 3. Grey areas represent 95% CI boundaries.

Alcohol Consumption

Analyses explored whether participants' alcohol consumption habits, specifically how often, and how much alcohol they consumed, might impact the previous analyses.

Reporting how often they consumed alcohol, 23.9% of participants indicated 2 to 3 times per week, 50.0% reported 2 to 4 times per month, and 19.6% once a month or less. One participant reported drinking more than four times per week, and was removed from subsequent analyses of alcohol consumption, but not from main analyses for this study. Most participants reported consuming less than 14 units per week (80.4%), with the remaining participants consuming less than 20 units.

Non-parametric tests were used to explore whether correlations between the MFQ and MFCT, and response times and Ex-Gaussian parameters in completing the MFCT, differed based on consumption habits. Any differences may indicate that the alcohol condition differentially affected performance on the MFCT based on participants' experience with alcohol. There were differences in participants' correlations between the MFQ and MFCT based on how often they drank, *Kruskal Wallis* $H(2) = 6.52$, $p < .05$, with pairwise comparisons indicating lower correlations ($p = .05$) when participants reported consuming alcohol once a month or less ($M = .43$, $SD = .32$) compared to participants that reported consuming alcohol 2 to 4 times per month (M = .73, SD = .22). However, there were no other significant pairwise comparisons (ps > .19). This suggests that participants who drank most infrequently were less consistent in their responses on the MFQ and the MFCT. There were no evident differences in correlations based on how many units were consumed per week, *Wilcoxon* W = 116.00, p > .10. Furthermore, there were no evident differences based on how often, RT: $H(2)$ = 1.00, μ: $H(2)$ = 2.34, τ: $H(2)$ = .27, or how much, RT: W = 85.00, μ: W = 95.00, τ: W = 80.00 (all ps > .10), alcohol tended to be consumed on participants' aggregate RTs and Ex-Gaussian parameters.

6.2.3 Discussion

As in Study 2, we found that a cognitive load manipulation – alcohol consumption – did not affect the correlation between foundation endorsement on the MFQ and the MFCT. This was somewhat supported by a Bayes factor indicating weak evidence for the null hypothesis of no difference between mean participant correlations across conditions. Unlike for Study 2, response times tended to be longer in the alcohol condition, enhancing confidence that this condition effectively increased load when completing the MFCT.

Similar to previous studies, we found that, collapsed across condition, foundation rankings measured on the MFQ and emerging from the MFCT correlated at $r_\tau\,(89)$ = .61. We also broadly replicated response time effects in the preceding studies, although again these effects are weak, with models of RT leaving large proportions of variance unexplained. We found that differences in both MFQ and MFCT scores predicted response times, such that a greater difference was associated with faster reaction time, and that response time and τ decreased with increasing ranks apart on participants' rank orderings on the MFQ. We interpret this as further support that responses on the MFCT are based on intuitive moral responses, and thus the MFCT is indeed an effective measure of intuitive foundation endorsement that captures variance not explained by the MFQ. To further explore the reliability of responses on the MFCT, we will compare responses on the normal version of the task to a version in which participants are encouraged to deliberate their choices in Study 4.

There are a number of limitations to this study. We hypothesised that, if responses on the MFCT are mostly the result of deliberated cognitive processes, then alcohol should interfere with this and reduce the correlation between the MFQ and

MFCT. As discussed, we did not find this to be the case. However, we did find that the most infrequent drinkers (once a month or less) did have lower correlations than those who drank more frequently (2 to 4 times a month). This finding is consistent with the above hypothesis, but is difficult to interpret, particularly as this pattern does not continue for more regular drinkers. We calculated alcohol dosage for each participant to achieve .03 BAC, a level at which cognitive impairment begins (Dubowski, 1980), but did not actually measure what BAC had been achieved for each participant, e.g. by using a breathalyser. This information might have aided interpretation and provided further support for the effectiveness of the alcohol manipulation.

Furthermore, we opted to recruit to condition, rather than by random assignment as in Study 2, in order to manage ethical considerations around requiring participants to consume alcohol in the lab. Thus, the alcohol condition was advertised separately, and participants were required to have previous experience with alcohol, and no health conditions that precluded drinking alcohol. However, no such requirements were placed on participants in the control condition. This recruitment method introduces a potential confound to this study, that would have been alleviated by placing the same requirements across conditions to avoid a drinkers vs. non-drinkers selection effect. In addition, participants in the alcohol condition participated for a longer period – around 40 minutes compared to around 20 minutes in the control condition – and therefore received a higher payment amount to reflect this. Here, we might have included a filler task in the control condition to avoid the limitations introduced by varied time and payment schemes across conditions.

Based on these three studies, we argue that there is sufficient evidence to conclude that scores on the MFCT can be collapsed across the structural blocks, that vary the valence and action formulation of items in the MFCT. Though there are some block differences, particularly in RT, these are consistent and reliable across multiple applications of the task and fairly stable to manipulations of cognitive load. Thus, for the remaining studies, we have omitted block-related analyses from the text and report these in Appendices. Additionally, we have shown that several methods of analysing RT and Ex-Gaussian parameters yield similar results across multiple samples. Though none of these methods show strong results, they support our interpretation that the MFCT is weakly, but consistently, tracking conflict in decisions between foundations. For Study 4 and 5, we report these analyses in Appendices.

7 Chapter 7: Deliberation on the Moral Foundations Conflict Task

7.1 Study 4

In Study 2 and 3, we explored whether associations between explicit moral endorsements on the MFQ, and fast, and arguably intuitive, choices on the MFCT are moderated by the availability of cognitive resources. These studies included conditions with a concurrent tone-counting task (Study 2) and alcohol (Study 3) as attention manipulations. In these studies, there was no evidence that the correlation between foundation preferences on the MFQ and on the MFCT was affected by cognitive load, suggesting that the MFCT provides a good measure of intuitive value endorsement. Including Study 1, and collapsing across conditions for Study 2 and 3, correlations between the MFQ and MFCT were observed at r_{τ} (75) = .50, r_{τ} (99) = .56, and r_{τ} (89) = .61, respectively.

This study explores whether this correlation will shift when the MFCT is completed with deliberation, rather than under load. We edited instructions for the task to encourage participants to employ deliberative cognitive effort in their responses, in order to compare these to speeded responses collected in previous studies, under instructions to make choices quickly based on gut responses.

To increase rigour, we preregistered the sample size, exclusion criteria, and hypotheses regarding correlations (https://osf.io/wxv5t). As observed in previous studies, we predicted a positive correlation between foundation preference in the deliberated version of the MFCT and the MFQ. However, we did expect a small difference between this correlation and that observed for normal speeded versions of the MFCT, such that the former would be higher: participants encouraged to make deliberated and considered choices between foundations on the MFCT will make responses that more closely match their responses on the MFQ.

7.1.1 Method

Participants

We preregistered a target sample size of 130, with an intention to recruit up to 150, assuming that not all participants would complete all measures or satisfy attention and compliance checks. This sample size was identified on the basis of a G*power analysis, a = .05 and β = .20, for a small effect size (Cohen's q = .30) for a test of differences between two independent correlations, comparing correlations in a deliberated version of the MFCT to previously collected control participants (N = 172) completing the normal version of the task from three previous studies (Study 1: N = 78; Study 2: N = 50; Study 3: N = 44). Assuming correlations of ~.50 in these versions, this is equivalent to an increase of .13 in Kendall rank correlation coefficient, predicting that correlations in the deliberated version will be ~.63.

We preregistered a number of exclusion criteria, mostly consistent with those applied in previous studies. We excluded participants who did not complete the MFQ. For the MFCT, we removed RTs shorter than 400ms, interpreting these as key presses before stimulus is processed. Contrary to previous studies which applied a 15 second cut-off, we removed long RT trials, interpreted as lapses in attention, by calculating a double Median Absolute Deviance (MAD) for values above (right MAD) the median, excluding trials more than 3 right MADs above median RT. Furthermore, participants were removed if the above exclusion criteria for RT data eliminated more than 10% of their trials.

Participants were also excluded if they: (1) answered with 'somewhat disagree', 'disagree', or 'strongly disagree' to the attention check item: 'It is better to do good than to do bad', widely used in the MFQ (Graham, Haidt, & Nosek, 2008; Graham et al., 2011); or (2) did not answer 'most of the time' or 'all of the time' to any of three compliance check items – 'I gave this survey my undivided attention while I was completing it', 'I sometimes just made random responses in order to get through this survey as quickly as possible' (reverse-coded), and 'I conscientiously attempted to follow instructions to the best of my ability'.

We were able to recruit one hundred and twenty-two participants from the participant pool in the Psychology Department at the University of Edinburgh. This pool is made up of first year Psychology students, and was that was limited to less than the target 150 total sample size by the size of the cohort for the 2018/19 academic year. All participants were current students, and received course credit for participation. Median RT was 1978ms – lower than might be expected, considering that participants were instructed to deliberate their responses. It was estimated that participation would last around 30 minutes, however median overall participant time was 12.1 minutes, suggesting than many participants may not have been sufficiently complying with instructions.

Applying our preregistered criteria, a total of 71 participants (57% of full sample) were excluded: Four participants due to missing data; a further 19 failed attention and compliance checks; and the final 48 participants were removed as RT criteria eliminated more than 10% of their trials. A total of 2,673 trials (16.9%) were removed across 119 subjects. This left a final sample size of 51 participants, a minimum RT of 479ms and a maximum of 5,836ms, and a total of 7,788 trials ($M_{RT\ Deliberation}$ = 2024ms; $SD_{RT\ Deliberation}$ = 1034ms). The same RT criteria applied to control data from previous studies removed 2,053 trials (7.5%) across 127 subjects of participants, with 44 participants losing more than 10% of their trials (26% of full sample), leaving a final sample of 127 (Study 1: N = 52; Study 2: N = 39; Study 3: N = 36), and a total of 26,844 trials ($M_{RT\ Control}$ = 1935ms; $SD_{RT\ Control}$ = 824ms). See Table 7.1 for summary of samples that will be used for preregistered analyses. Sample sizes reduced power to .55, to detect a small effect size (Cohen's q = .30). A sensitivity test conducted in G*Power indicated a required medium effect size (Cohen's q) of .42, given α = .05, β = .20, and sample size.

Table 7.1. Samples used for preregistered analyses in Study 4

	Final N (N excl.)	Females	M_{age} (SD_{age})	Kind of sample	Compensated	Used in study
Control	127 (44)	84 (66%)	23.20 (4.58)	Student sample (lab-based)	3 GBP	1, 2, 3
Deliberation	51 (71)	45 (88%)	19.10 (2.09)	Student sample (online)	Course credit	4

Note. Exclusions based on preregistered criteria.

Comparing within-subject mean RTs, by first calculating a mean for each participant and then comparing the mean of these values across the conditions, there was no evidence for a difference between the deliberation ($M_{Within\text{-}subject\ RT\ Deliberation}$ = 2026ms, $SD_{Within\text{-}subject\ RT\ Deliberation}$ = 371ms) and control samples ($M_{Within\text{-}subject\ RT\ Control}$ = 1942ms, $SD_{Within\text{-}subject\ RT\ Control}$ = 382ms), *Wilcoxon W* = 3588.00, $p > .10$. We would have expected that participants completing the deliberated version of the task would take longer to complete it. It is likely that, because a large portion of participants may not have been sufficiently complying with instructions to deliberate over their responses, the preregistered RT exclusion criteria based on double MAD actually served to eliminate longer RTs, and thus cases where participants were more likely to have been complying.

To address this, we will run exploratory analyses with samples applying the 15 second cut-off to longer RTs used in previous studies (see Table 7.2). In these samples, RT was longer in the deliberation ($M_{Within\text{-}subject\ RT\ Deliberation}$ = 2725ms, $SD_{Within\text{-}subject\ RT\ Deliberation}$ = 808ms) versus control sample ($M_{Within\text{-}subject\ RT\ Control}$ = 2374ms, $SD_{Within\text{-}subject\ RT\ Control}$ = 798ms), W = 9054.00, $p < .05$. Power achieved with this sample size is .72 to detect a small effect size. Here, a sensitivity test indicated a required effect size of .34.

Table 7.2. Samples used for exploratory analyses in Study 4

	Final *N* (*N* excl.)	Females	M_{age} (SD_{age})	Kind of sample	Compensated	Used in study
Control	168 (4)	111 (66%)	23.70 (4.60)	Student sample (lab-based)	3 GBP	1, 2, 3
Deliberation	85 (37)	70 (82%)	19.10 (1.73)	Student sample (online)	Course credit	4

Note. Exclusions applying a 15 second cut-off for longer RTs instead of the preregistered criteria of more than 3 right MADs above median RT. Other preregistered exclusion criteria were maintained.

Measures and Procedure

All participants completed the MFQ and MFCT in randomised order. However, unlike the previous studies, participants completed both online.

Contrary to the normal speeded version of the MFCT used in Studies 1, 2 and 3, in which participants are instructed to make choices quickly based on gut feeling, the deliberated version of the MFCT instructed participants to take time to deliberate and make choices as accurately as they can.

For the preregistered sample, subscale reliabilities for the deliberation sample (N = 51) on the MFQ were care (α = .71), fairness (α = .62), authority (α = .73), loyalty (α = .63), and purity (α = .75). For the combined control sample (N = 127), reliabilities were care (α = .60), fairness (α = .61), authority (α = .66), loyalty (α = .67), and purity (α = .78).

For the larger exploratory samples, reliabilities on the MFQ were care (α = .72), fairness (α = .62), authority (α = .72), loyalty (α = .62), and purity (α = .74) for the deliberated version (N = 85); and care (α = .59), fairness (α = .62), authority (α = .65), loyalty (α = .67), and purity (α = .80) for the combined control sample (N = 168).

All the above subscale reliabilities were judged to be acceptable, and were of similar magnitudes to those in previous studies (care = .38 < αs < .77; fairness = .55 < αs < .73; authority = .63 < αs < .72; loyalty = .68 < αs < .73; purity = .79 < αs < .83).

7.1.2 Results

We separate results into preregistered analyses conducted on samples outlined in Table 7.1, and exploratory analyses applied to samples in Table 7.2. Preregistered analyses will test hypotheses regarding associations between responses in the MFCT and MFQ scores. Exploratory analyses will repeat these analyses. Models exploring differences in response or RT patterns across blocks on the MFCT, and RTs on the MFCT as indicators of conflict in decisions between foundations are reported in Appendix 3.

In contrast with our hypothesis, we found no evidence for a difference between control and deliberation conditions in either the preregistered or exploratory analyses reported below. However, as discussed above and below in the discussion of this study, there are a number of substantial limitations to our deliberation manipulation that hinder interpretation of these results. Correlations between MFQ and MFCT foundation preferences were of similar magnitudes to that observed in previous studies, adding convergent support that this is a stable relationship.

Preregistered analysis

Correlating MFQ and MFCT

Mean responses on the MFQ and the MFCT for the deliberated version of the task, are shown in Table 7.3, along with correlations. The correlations for care, $r = .59$, $p <. 001$, authority, $r = .67$, $p < .001$, and loyalty, $r = .60$, $p < .001$ are significant, with marginal significance for purity, $r = .38$, $p < .10$, however this was not the case for fairness, $r = .31$.

Kendall rank correlation coefficients between deliberated MFCT and MFQ responses, calculated for each participant, ranged from -.32 to 1.00, and between -.74 and 1.00 for the control. There was no evidence for a difference between correlations in the control, r_τ (127) = .52, and deliberation versions of the MFCT, r_τ (51) = .59, *95% CI* [-.07, .20] (see Table 7.4). Cohen's q for a difference between these correlations is calculated to be .18, a small effect if present, and far lower than the required effect size of .42 indicated by a sensitivity test.

Table 7.3. Descriptive statistics and Pearson correlations for preregistered deliberated sample

	M	*SD*	1	2	3	4	5	6	7	8	9
1. Care-MFQ	3.82	.71									
2. Fairness-MFQ	3.88	.56	.54***								
3. Authority-MFQ	2.39	.81	-.20	-.15							
4. Loyalty-MFQ	2.60	.79	-.19	-.01	.63***						
5. Purity-MFQ	2.06	.86	-.11	-.19	.74***	.49**					
6. Care-MFCT	.75	.15	**.59*****	.24	-.49**	-.47**	-.28				
7. Fairness-MFCT	.56	.14	.14	**.31**	-.38*	-.32	-.58***	.00			
8. Authority-MFCT	.39	.10	-.43*	-.20	**.67*****	.39*	.43*	-.62***	-.22		
9. Loyalty-MFCT	.48	.10	-.19	-.21	.25	**.60*****	.32	-.44*	-.36†	.15	
10. Purity-MFCT	.32	.13	-.35	-.31	.28	.15	**.38†**	-.36†	-.64***	.07	.05

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. MFQ scores are on a 0 to 5 scale, MFCT scores are on a 0 to 1 scale. p-values corrected for multiple comparisons (Bonferroni). Correlations between the same foundations on the MFQ and on the MFCT have been highlighted in bold.

As in Study 2 and 3, we conducted a non-parametric Mann–Whitney U test with a Bayes factor to help interpret non-significance. This confirmed non-significance, U =

2956.00, Z = -.91, p = .40, r = .09, and with a Bayes factor, BF_{10} = .23, indicating moderate evidence for the null (Jeffreys, 1939/1961; Lee & Wagenmakers, 2014; van Doorn et al., 2020)

Table 7.4. Correlations between MFQ and MFCT scores across preregistered versions of the MFCT for Study 4

	Sample r_{τ}	$r_{\tau Boot}$	Bias	95% CI of r_{τ}	SE $r_{\tau Boot}$	95% CI of Difference
Control (N = 127)	.52	.53	-.016	[.48, .62]	.035	[-.07, .20]
Deliberation (N = 51)	.59	.63	-.039	[.57, .74]	.046	

Note. Bootstrapped with 5,000 iterations. CIs are the Bias Corrected Accelerated (BCa) intervals

These results show the predicted positive correlation between the deliberated version of the MFCT and the MFQ, of similar magnitude to that observed in previous studies. Contrary to our second prediction, there is no evidence for a difference between this correlation and that observed for normal speeded versions of the MFCT. However, this comparison was under-powered ($1 - \beta$ = .55). Preregistered exclusion criteria reduced sample size more than expected, likely an indication that participants were not properly complying with instructions, and that the chosen criteria may instead serve to exclude longer trials on which participants were, in fact, complying with instructions to deliberate carefully over their responses.

To explore, this we will replicate the above analyses, applying instead the 15 second cut-off to longer RTs used in previous studies, and reported as exploratory below.

Exploratory analysis

Correlating MFQ and MFCT

As above, mean responses and correlations for the deliberated version of the task are shown in Table 7.5. The correlations for care, r = .50, p <. 001, fairness, r = .36, p < .01, authority, r = .57, p < .001, loyalty, r = .57, p < .001 and purity, r = .38, p < .01, were all significant.

Table 7.5. Descriptive statistics an Pearson correlations for exploratory deliberated sample

	M	*SD*	1	2	3	4	5	6	7	8	9
1. Care-MFQ	3.79	.69									
2. Fairness-MFQ	3.84	.54	.64***								
3. Authority-MFQ	2.41	.80	-.19	-.11							
4. Loyalty-MFQ	2.57	.75	-.12	.05	.61***						
5. Purity-MFQ	2.13	.84	-.11	-.14	.69***	.50***					
6. Care-MFCT	.74	.14	**.50*****	.26	-.42***	-.40**	-.30*				
7. Fairness-MFCT	.55	.14	.19	**.36****	-.43***	-.29†	-.47***	.15			
8. Authority-MFCT	.40	.12	-.39**	-.27	**.57*****	.24	.34*	-.62***	-.40**		
9. Loyalty-MFCT	.46	.10	-.16	-.16	.23	**.57*****	.23	-.37**	-.39**	.02	
10. Purity-MFCT	.34	.12	-.31*	-.32*	.25	.12	**.38****	-.46***	-.60***	.20	.05

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. MFQ scores are on a 0 to 5 scale, MFCT scores are on a 0 to 1 scale. *p*-values corrected for multiple comparisons (Bonferroni). Correlations between the same foundations on the MFQ and on the MFCT have been highlighted in bold.

Kendall rank correlation coefficients between the deliberated MFCT and MFQ ranged from -.40 to 1.00, and between -.89 and 1.00 for the control. There was again no evidence for a difference between correlations in the control, r_τ (168) = .52, and deliberation versions of the MFCT, r_τ (85) = .57, *95% CI* [-.06, .16] (see Table 7.6). Cohen's q for a difference between these correlations is calculated to be .12, a smaller effect size than for preregistered versions. Though closer to adequate power (.80), this comparison was also under-powered ($1 - \beta = .71$).

A non-parametric Mann–Whitney U test confirmed non-significance, U = 6671.00, Z = -.86, p = .40, r = .09, and with a Bayes factor, BF_{10} = .18, indicating moderate evidence for the null (Jeffreys, 1939/1961; Lee & Wagenmakers, 2014; van Doorn et al., 2020).

Table 7.6. Correlations between MFQ and MFCT scores across exploratory versions of the MFCT for Study 4

	Sample r_τ	$r_{\tau Boot}$	Bias	95% CI of r_τ	$SE\ r_{\tau Boot}$	95% CI of Difference
Control (*N* = 168)	.52	.51	.016	[.42, .55]	.030	[-.06 , .16]
Deliberation (*N* = 85)	.57	.57	.001	[.50, .64]	.037	

Note. Bootstrapped with 5,000 iterations. CIs are the Bias Corrected Accelerated (BCa) intervals

7.1.3 Discussion

In this study, we attempt to test assumptions that the MFCT is an intuitive level of measurement by testing whether associations between it and the MFQ shift when choices were deliberated. To this effect, we sought to manipulate cognitive attention in the opposite direction to that in Studies 2 and 3, where the MFCT is completed under load. Specifically, we expected that participants encouraged to deliberate and carefully consider choices on the MFCT, thus engaging reflective processes, would make responses that more closely matched their responses on the MFQ. We predicted a small effect for a test of difference between this version of the MFCT, and the standard version of the task used in previous studies, predicting that correlations for the former would be higher. However, we found no such evidence for a difference, with Bayes factors in both a pre-registered and exploratory sample indicating moderate evidence for the null.

Associations between foundation preferences on the MFCT and MFQ were of similar magnitude (preregistered sample: $r_\tau(51) = .57$; exploratory sample: $r_\tau(85) = .59$) to that observed in previous studies, adding convergent support that this is a stable relationship. However, there are a number of substantial limitations to this study that hinder any further interpretation. In particular, fast overall times to complete the deliberated version of the task suggest that it is unlikely that participants were complying with instructions to deliberate (despite reporting to be doing so in compliance checks), and thus that our manipulation likely failed. Due mostly to expectations that responding to the deliberated version of the task would take longer, our preregistered exclusion criteria eliminated a large portion of participants, and thus our comparison was under-powered ($1 - \beta = .55$). When we applied less stringent RT criteria, though closer to adequate power (.80), this comparison remained under-powered ($1 - \beta = .71$).

There are a number of explanations for why our manipulation might have failed. The deliberated sample was collected online, in contrast to previous lab-based samples. Whilst replicating the stable association between the MFCT and MFQ in this study suggests that the MFCT may operate reliably online, this may have been inappropriate for this kind of manipulation of attention. Future studies that deliver this or similar manipulations in the lab may have more success. Furthermore, the task entails 160 choices between foundations, and therefore making each of these carefully is cognitively demanding. Thus, participants may be defaulting to intuitive responding, regardless of any instructions not to do so. To improve on this methodological limitation and encourage deliberation, we might have implemented a time window for each choice in the MFCT (e.g. 15 seconds), not permitting participants to respond before this time had elapsed. Furthermore, future work exploring links between cognitive style variables, such as need for cognition, and individual consistency between intuitive MFCT and explicit MFQ responses may present an alternative way of getting at this question. However, we turn away from this in Study 5, instead exploring associations with established correlates of the MFQ.

8 Chapter 8: Predicting correlates of the Moral Foundations Questionnaire

8.1 Introduction

Studies 1 to 4 indicate that the MFCT, as a novel measure of fast intuitive choices between moral foundations, correlates reliably with the MFQ, an established measure of foundation endorsement, and hence increase confidence in the MFCT's concurrent validity (Murphy & Davidshofer, 1988). We have found that they correlate at $.50 < r_\tau < .61$. One explanation of this magnitude of correlation is that the MFCT presents a noisy measure of foundation endorsement that is better measured by the MFQ. Another explanation is that, rather than merely noisily reflecting MFQ scores, the MFCT captures systematic, non-overlapping variance in foundation endorsement. In Study 5, we aim to distinguish between these two explanations by investigating whether responses on the MFCT predict established correlates of the MFQ.

8.1.1 Correlates of the Moral Foundations Questionnaire

The pragmatic validity of MFT, and the moral pluralism it theorises, have been argued for on the basis that MFT has produced a wealth of novel empirical findings (Graham et al., 2013). These findings include work on political ideology (Franks & Scherr, 2015; Frimer, Biesanz, Walker, & MacKinlay, 2013; Graham, 2010; Graham et al., 2009; Graham et al., 2012; Graham et al., 2011; Haidt & Graham, 2007; Haidt et al., 2009), political attitudes (Barnett & Hilz, 2018; Barnett, Öz, & Marsden, 2018; Dawson & Tyson, 2012; Day, Fiske, Downing, & Trail, 2014; Dickinson, McLeod, Bloomfield, & Allred, 2016; Federico et al., 2013; Koleva, Graham, Iyer, Ditto, & Haidt, 2012; Kugler et al., 2014; Leone, Giacomantonio, & Lauriola, 2019; Low & Wui, 2016; Malka et al., 2016; McAdams et al., 2008; Milesi, 2016; Silver & Silver, 2017; Vainio & Mäkiniemi, 2016; Van de Vyver et al., 2016; Van Leeuwen & Park, 2009; Vecina & Chacon, 2019; Vecina & Pinuela, 2017), cross-cultural differences (Alsheddi, Russell, & Hegarty, 2019; Bulbulia, Osborne, & Sibley, 2013; Doğruyol et al., 2019; Iurino & Saucier, 2020; Matsuo, Sasahara, Taguchi, & Karasawa, 2019; Milesi, 2017; Nilsson & Erlandsson, 2015; Yilmaz

& Saribay, 2017a), and a number of other constructs (Bulbulia et al., 2013; Hirsh, Deyoung, Xiaowen, & Peterson, 2010; Koleva, Selterman, Iyer, Ditto, & Graham, 2014; Lewis & Bates, 2011; Nilsson, Erlandsson, & Västfjäll, 2016; O'Grady & Vandegrift, 2019). This breadth of empirical applications provides convergent and discriminant validity for MFT.

Although MFT is fundamentally an intuitionist account of morality and despite a number of other methods developed to test MFT, the MFQ (Graham et al., 2011) as a self-report survey measure, has been most widely applied (Graham et al., 2013). Within the empirical work cited above, foundation endorsement on the MFQ has been correlated with left-right political orientation (Franks & Scherr, 2015; Graham et al., 2009; Graham et al., 2012; Graham et al., 2011), as well as a number of political and social attitudes including authoritarianism and social dominance orientation (Federico et al., 2013; Kugler et al., 2014; McAdams et al., 2008; Van Leeuwen & Park, 2009), prejudice (Van de Vyver et al., 2016), sexism (Vecina & Chacon, 2019; Vecina & Pinuela, 2017), and attitudes towards the poor (Low & Wui, 2016), rape (Barnett & Hilz, 2018), homosexuality (Barnett et al., 2018), and climate change (Dawson & Tyson, 2012; Dickinson et al., 2016; Vainio & Mäkiniemi, 2016). In addition, foundation endorsement on the MFQ has been correlated with a number of other constructs and behaviours, including personality traits (Hirsh et al., 2010; Lewis & Bates, 2011), attachment style (Koleva et al., 2014), charitable giving (Nilsson et al., 2016; O'Grady & Vandegrift, 2019), and religious orientation (Bulbulia et al., 2013).

Political orientation

Of these many and varied correlates, left-right political orientation remains the most widely replicated, and what MFT is best known for (Graham et al., 2013). Initially developed to explain variation in virtue concepts across cultures (Haidt & Joseph, 2004) building on previous work in this domain (Shweder, 1990; Shweder et al., 1997; Turiel et al., 1991), MFT was not developed to account for ideological differences. However, the list of foundations mapped cleanly and easily to explain disagreement in the ‘culture wars’ between US liberals and conservatives, and MFT’s first empirical findings explains this intractability in moral disputes as a function of differences in foundation endorsement (Haidt & Graham, 2007). Restating these differences, liberals endorse the individualising moral foundations of care and fairness, focusing on moral concern for individuals, more strongly than the binding foundations of authority, loyalty, and purity, focusing on moral concern for groups. Conservatives, on the other hand, value foundations relatively equally. These systematic ideological differences in foundation endorsement (Franks & Scherr, 2015; Graham et al., 2009; Graham et al., 2012; Graham et al., 2011) have been widely captured by the MFQ (Graham et al., 2011), and though there are some contexts in which they do not replicate (Davis et al., 2016), have been observed across cultures (Graham et al., 2009; Milesi, 2016, 2017; Nilsson & Erlandsson, 2015; Van Leeuwen & Park, 2009).

Conservative morality and critiques

On the basis of core differences in foundation endorsement, liberal-conservative moral disagreement occurs because conservatives value moral foundations that liberals do not. Thus, reconciling the moral intractability between ideological camps would require liberals to recognise moral foundations (i.e. binding foundations) that they do not value, but which are important for conservatives (Haidt, 2015). According to Haidt (2015), liberals are 'moral monists', with a narrower morality than that of conservatives. As an extension of this, scientific understanding of morality has focused too narrowly on 'liberal' values aligned with classic approaches to moral psychology in Kohlberg's (1971, 1973) ethics of justice and Gilligan's (1982) ethics of care (Haidt & Graham, 2007, 2009; Haidt et al., 2009). In contrast, MFT defines morality in a way that "does not exclude conservative and non-Western concerns'' (Graham et al., 2009, p.1030).

This effort to broaden scientific conceptions of morality has been met with criticism that centres on the status of binding foundations as 'moral'. Here, critics argue that though MFT presents itself as a descriptive theory about the content of people's moral concerns, it makes clear normative prescriptions about what should be considered as moral (Jacobsin, 2008; Jost, 2012; Kugler et al., 2014), and can be situated in a wider agenda to incorporate conservative ideas in social psychology (Duarte et al., 2015; Tetlock, 2012). On this basis, there is a need to scrutinise the validity of the conservative 'morality' packaged in the binding foundations.

Kugler et al. (2014) argue that the, supposedly 'moral', binding foundations are manifestations of right-wing authoritarianism (RWA) and social dominance orientation (SDO), two established dimensions that predict conservatism (Adorno, Frenkel-Brunswik, Levinson, & Sanford, 1950; Altemeyer, 1996, 1998; Jost, Federico, & Napier, 2009; Jost et al., 2003; Jost, West, & Gosling, 2009; Napier & Jost, 2008; Pratto, Sidanius, Stallworth, & Malle, 1994; Sidanius & Pratto, 1999; Sidanius, Pratto, & Bobo, 1996; Stone & Smith, 1993). This is predicated by decades of work showing associations between RWA and SDO, both separately and in conjunction, with a number of unsavoury social and political attitudes, including ingroup favouritism, sexism, racism, classism, homophobia, prejudice, discrimination against disadvantaged groups, and punishment of social deviants (Adorno et al., 1950; Altemeyer, 1996, 1998; Duckitt, 2001; Duckitt & Sibley, 2010; McFarland, 2010; Napier & Jost, 2008; Sidanius & Pratto, 1999; Sidanius et al., 1996; Whitley Jr & Lee, 2000; Wilson & Sibley, 2013). On this basis, Kugler et al. (2014) argue for scientific grounds for doubting MFT claims that binding foundations should be considered as 'moral values'.

RWA, SDO and binding foundations

Right-wing authoritarianism (RWA) is broadly conceptualised as a personality dimension comprised of a preference for strong leaders and deference to authorities, respect for the social conventions endorsed by authorities, and hostility toward outgroup members and those who violate social conventions (Altemeyer, 1996, 1998). Social dominance orientation (SDO), on the other hand, is a personality dimension comprised of a preference for group-based inequality and dominance versus equality and inclusion (Pratto et al., 1994; Sidanius & Pratto, 1999).

A number of studies have found associations between foundation endorsement on the MFQ, and RWA and SDO. McAdams et al. (2008) found that themes relating to loyalty, authority, and purity were significantly more common in the narratives of individuals who scored high (vs. low) on RWA and, to a lesser extent, SDO. Federico et al. (2013) observed that endorsement of loyalty, authority, and purity on the MFQ were strongly correlated with RWA – along with other measures of preferences for openness versus social conformity (i.e. dangerous-world beliefs) – while endorsement of care and fairness were negatively correlated with SDO, and other measures of preference for equality versus inequality (i.e. competitive-jungle beliefs). Hadarics and Kende (2017) replicated these associations, showing that RWA correlates positively, and SDO negatively, with binding and individualising foundations. In a large representative sample, Milojev et al. (2014) found that RWA and SDO were both positively correlated with the endorsement of loyalty, authority, and purity, while SDO was negatively correlated with the endorsement of care and fairness. Furthermore, Van Leeuwen and

Park (2009) found that RWA, SDO, and endorsement of binding foundations share psychological antecedents, such as perceptions of a dangerous world, consistent with conceptions of political conservatism as motivated social cognition (Jost et al., 2003; Wright & Baril, 2013).

To this effect, Kugler et al. (2014) found that liberal-conservative differences in foundation endorsement are partially attributable to, i.e. mediated by, differences in RWA and SDO. In a combined student and online sample (total *N* = 351), Kugler et al. (2014) fit a mediation model (see Figure 8.1) showing that liberal-conservative differences in endorsement of the binding foundations of loyalty (labelled as ingroup loyalty), authority (obedience to authority), and purity is mediated by positive associations with RWA and, in part, with SDO, and is thus attributable to the fact that conservatives tend to be higher than liberals on these dimensions. Furthermore, liberal-conservative differences in endorsement of the individualising foundations of care (harm avoidance) and fairness is attributable to the fact that liberals tend to be lower than conservatives on social dominance orientation.

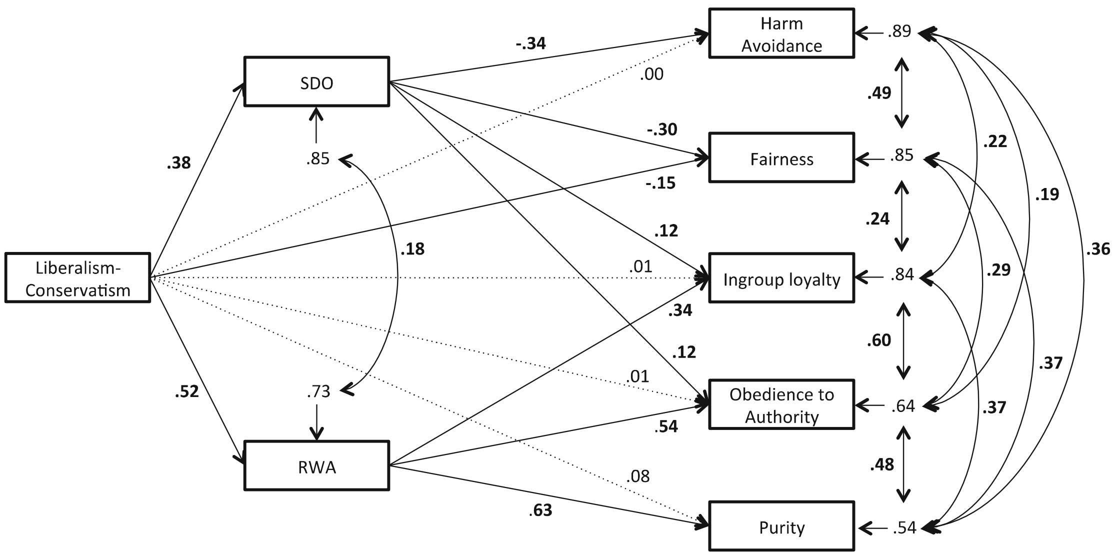

Figure 8.1. Mediation model from Kugler et al. (2014, p.423) illustrating that RWA and SDO mediate the relationship between political orientation and moral foundations. Path coefficients are standardised regression coefficients of a trimmed path model. Broken lines indicate non-significant paths at $p < .05$.

8.1.2 The present study

Measuring foundation endorsement on the MFQ, previous literature has found that: (a) liberals score high in the two individualising foundations (care and fairness) and low in the three binding foundations (authority, loyalty and purity), whereas conservatives score highly across all five; (b) RWA positively correlates with the endorsement of binding concerns; and (c) SDO positively correlates with endorsement of binding foundations and negatively with the endorsement of individualising foundations. Furthermore, Kugler et al. (2014) found that liberal-conservative differences in foundation endorsement are partially mediated by RWA and SDO.

We seek to replicate the mediation model fit by Kugler et al. (2014) that sets foundation endorsement measured by the MFQ in a framework that examines their empirical connections to political orientation, RWA, and SDO, as three key correlates crucial to debates about moral foundations. In particular, we seek to explore whether these structured empirical connections are replicated with response patterns on the MFCT, and if foundation endorsement on the MFCT might capture unique variance with these correlates, over and above the MFQ.

It is not our intention here to speak directly to the outlined debate on the nature and status of binding foundations. However, we argue that exploration into the structure and nature of moral foundations is hindered by the reliance on the MFQ as a self-report measure. As highlighted by Jost (2012), a ‘conservative’ moral profile on the MFQ is characterised with high agreement, and answering ‘yes’, on all items. This opens the MFQ up to the criticism that conservative patterns of responding are driven by a greater acquiescence bias, linked to more intuitive thinking (Knowles & Condon, 1999). Therefore, liberal-conservative differences on the MFQ may merely result from differences in propensities for analytic thought (Yilmaz & Saribay, 2017a), related to wider ideological differences in epistemic motives (Jost et al., 2003). The MFCT is robust to this methodological critique, measuring foundation endorsement by how often foundations are chosen when in conflict with other foundations. Furthermore, we have found no evidence that the MFCT is affected by manipulations of cognitive load (see Chapter 6), and thus it may be better adapted to probe questions regarding liberal-conservative differences.

Hypotheses

In this study, as in previous, we will measure foundation endorsement on both the MFQ and the MFCT. Alongside this, we will also include measures of political orientation, RWA, and SDO. We preregistered sample size, exclusion criteria, and hypotheses (https://osf.io/nbwz4). We predicted a positive correlation between the MFCT and MFQ, of similar magnitude to that observed in previous studies. We also predicted, with small effects as in previous studies, greater conflict in decisions between closely-valued foundations, as measured by raw RT scores and fitted τ parameters (but not necessarily μ parameters).

With correlates, we hypothesised that: higher conservatism would be weakly negatively correlated with MFQ and MFCT scores for individualising foundations (care and fairness) and moderately positively correlated with binding scores (authority, loyalty and purity); social dominance would be moderately negatively correlated with individualising scores and moderately positively correlated with binding scores; and authoritarianism would be moderately to strongly positively correlated with binding scores. We also expected to replicate Kugler et al. (2014), with the effect of political orientation on MFQ scores and MFCT scores mediated by social dominance and authoritarianism. We did not have specific predictions about whether this mediation will be stronger for MFCT scores compared to MFQ scores.

Finally, we expected that higher conservatism would predict: lower consistency in associations between MFQ scores and MFCT scores; and higher average RT and τ values in the task indicating greater levels of conflict.

8.2 Study 5

8.2.1 Method

Participants

We preregistered a target sample size of 700, with an intention to recruit up to 850, assuming that not all participants would complete all measures or satisfy attention and compliance checks. This sample size was identified to double the sample size (N = 351) used by Kugler et al. (2014).

A total 854 participants were recruited online (prolific.ac) and were required to be UK residents, over 18 years of age, and native English speakers – only those who met these criteria were able to access the study. Participants were compensated £1.85.

In line with preregistered criteria, 90 participants were removed due to missing data, and a further 32 failed attention and compliance checks (as applied in Study 4). As data was collected online, we expected higher numbers of error trials than in previous lab-based studies. Therefore, we calculated Median Absolute Deviance (MAD) for values below the median (*left MAD* = 391ms), excluding trials more than 3 *left MADs* below median RT (1550ms) to give a lower threshold of 377ms. In line with previous studies, we excluded RT trials longer than 15 seconds (not based on MAD above median as this clips RT distribution tails and limits Ex-Gaussian analyses). A total of 1864 trials (1.4%) were removed across 129 subjects. A further 32 subjects were removed because more than 10% of their trials were eliminated, leaving a total of 111,709 trials (M_{RT} = 1843ms; SD_{RT} = 1043ms). Figure 8.2Figure 5.1 shows a histogram of the distribution of RTs across all trials. The final sample consisted of seven hundred participants (61% females; M_{age} = 37.50; SD_{age} = 12.06).

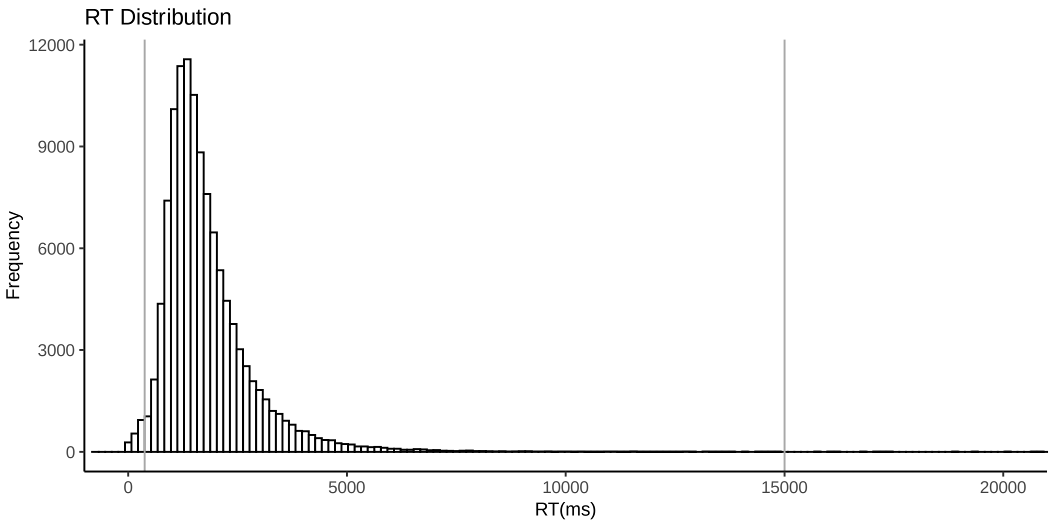

Figure 8.2. Distribution of RTs across all trials in Study 5. Grey reference lines indicate cut-off points of 377ms and 15,000ms.

Measures and Procedure

Participants completed five main measures online in randomised order. This included the MFQ and MFCT. Subscale reliabilities for the MFQ were judged to be acceptable – care (α = .62), fairness (α = .65), authority (α = .79), loyalty (α = .73), and purity (α = .81) – and were of similar magnitudes to those in previous studies (care = .38 < αs < .77; fairness = .55 < αs < .73; authority = .63 < αs < .73; loyalty = .62 < αs < .73; purity = .74 < αs < .83).

Political ideology

To measure political ideology, we administered three items used by Carney, Jost, Gosling, and Potter (2008): (1) 'Where on the following scale of political orientation (from extremely liberal to extremely conservative) would you place yourself (overall, in general)?'; (2) 'In terms of social and cultural issues in particular, how liberal or conservative are you?'; and (3) 'In terms of economic issues in particular, how liberal or conservative are you?'. Responses were provided on a 7-point scale ranging from 1 (Very liberal) to 7 (Very conservative). These three items formed a highly reliable index (α = .93). We took the mean as an estimate of overall political ideology (M = 3.29, SD = 1.36).

Social Dominance Orientation (SDO)

We administered the 16-item social dominance orientation Scale (SDO-6) developed by Pratto et al. (1994). Sample items include ‘To get ahead in life, it is sometimes necessary to step on other groups’, and ‘No one group should dominate in society’ (reverse-coded). For the combined sample, scale reliability was again high (α = .94), with responses ranging from 1 to 6.13 (M = 2.42, SD = 1.05).

Right-Wing Authoritarianism (RWA)

We administered the 8-item version of the right-wing authoritarianism scale used by Sibley and Duckitt (2009). Sample items include ‘The only way our country can get through the crisis ahead is to get back to our traditional values, put some tough leaders in power, and silence the troublemakers spreading bad ideas’, and ‘Our country will be destroyed some day if we do not smash the perversions eating away at our moral fiber and traditional beliefs’. Scale reliability was high (α = .80), with responses ranging from 1 to 7 (M = 2.71, SD = 1.07).

8.2.2 Results

We separate results into analyses regarding associations between MFCT responses and scores on the MFQ, political orientation, SDO and RWA, and analyses on RTs on the MFCT as indicators of conflict in decisions between foundations. Within these sections, we have identified preregistered and exploratory analyses. In addition, we also replicated exploratory analyses looking at response and RT patterns across blocks on the MFCT, which were largely consistent with previous studies and are reported in Appendix 4.

Relating to our hypotheses, in the following analyses we confirm the positive correlation between the MFCT and MFQ with a similar magnitude to that observed in previous studies. We also find the expected associations between political orientation, SDO and RWA and foundation endorsement with both the MFQ – and importantly – the MFCT. In separate mediation models with MFQ and MFCT scores, we successfully replicate Kugler et al. (2014), showing the effect of political orientation is mediated by social dominance and authoritarianism. Furthermore, we find that a mediation model with MFCT scores explains more variance than a model fit to MFQ scores. In exploratory mediation models, we further show that, by removing variance shared by the two measures, unique variance in MFCT scores accounts for unique structured relationships in these models. Additionally, we found that higher conservatism predicted lower consistency in associations between MFQ and MFCT scores, as expected. However, we also found that higher conservatism predicted lower RT and τ values indicating less conflict in decisions in the MFCT, rather than more as hypothesised. Finally, we also replicate previous effects in RT patterns, with evidence of greater conflict – though with small effects – in decisions between closely-valued foundations.

Responses on the MFCT

Preregistered analysis

Regarding responses on the MFCT, we tested the following preregistered predictions. Firstly, we predicted that patterns of responses on the MFCT will positively correlate with patterns of MFQ scores. This correlation will be moderate in size, and approximately .50, given past studies. Furthermore, we predicted that higher conservatism, and thus endorsement of a wider array of values, would predict lower consistency, and thus lower correlations between MFCT and MFQ scores. We had no specific predictions about the size of this effect.

With political orientation, social dominance, and authoritarianism, we expected to replicate previous findings with both MFQ and MFCT scores (predicted magnitudes of effects indicated in brackets). We expected that political orientation (medium), SDO (medium), and RWA (medium to large) would be positively correlated with the endorsement of authority, loyalty, and purity scores. We also expected that political orientation (small) and SDO (medium) would be negatively correlated with care and fairness scores.

In addition, we expected to replicate mediation models in Kugler et al. (2014) with both MFQ and MFCT scores, with individual differences in SDO and RWA mediating the effect of political orientation on the endorsement of moral foundations.

Correlations

Mean responses on the MFQ and the MFCT are shown in Table 8.1, along with correlations across foundations. Correlations were significant for all foundations (care:

$r = .37$, $p <. 001$; fairness: $r = .35$, $p < .001$; loyalty: $r = .32$, $p < .001$; authority: $r = .59$, $p < .001$; and purity: $r = .38$, $p < .001$).

Kendall rank correlation coefficients ranged from -1.00 to 1.00, with a mean of r_{τ} (700) = .47. To assess stability, this estimate was bootstrapped to give an estimate of $r_{\tau Boot} = .46$ ($SE\ r_{\tau Boot} = .01$, *95% CI* [.43, .49]). These results show the predicted positive correlation between the MFCT and the MFQ, of similar magnitude to that observed in previous studies.

In line with our predictions, authority, loyalty and purity positively correlated, tending towards medium effects, with political orientation, $.22 < r$s $< .50$, ps $< .001$, and SDO, $.29 < r$s $< .43$, ps $< .001$, and with large effects with RWA, $.37 < r$s $< .69$, ps $< .001$, with the exception of loyalty on the MFCT, $r = .19$, $p < .001$. Care and fairness were negatively correlated with SDO, $-.33 > r$s $> -.54$, ps $< .001$, with predicted medium effects, and also with political orientation, $-.24 > r$s $> -.47$, ps $< .001$, and SDO, $-.33 > r$s $> -.54$, ps $< .001$, though we had predicted small effects for the latter. In addition, RWA also negatively correlated with care and fairness, more so on the MFCT, rs = -.37 and -.55, ps $< .001$, than on the MFQ, $-.11 > r$s $> -.19$, ps $< .05$.

Mediation models

We built two sets of path analyses (saturated and trimmed models) to test whether the effect of political orientation on foundation scores on (a) the MFQ and (b) the MFCT, are mediated by SDO and RWA. Models for (a) are a direct replication of analyses in Kugler et al. (2014). Trimmed models excluded non-significant pathways between SDO/RWA and foundation scores. Confidence intervals were estimated for indirect paths. Mediation models were fit with the *sem* function in the *lavaan* package (version .6-5) (Rosseel, 2012).

Predicting MFQ scores

Saturated model

We built the saturated model illustrated in Figure 8.3, RMSEA of 0, and TLI of 1. Replicating previous effects, this model yielded positive associations between political orientation and SDO, $\beta = .52$, $SE = .03$, $p < .001$, and RWA, $\beta = .50$, $SE = .03$, $p < .001$. Political orientation explained 27.5% of the variance in SDO and 24.7% of the variance in RWA.

Table 8.1. Descriptive statistics and Pearson correlations in Study 5

	M	*SD*	1	2	3	4	5	6	7	8	9	10	11	12
1. Political Orientation	3.29	1.36												
2. SDO	2.42	1.05	.52***											
3. RWA	2.71	1.07	.50***	.45***										
4. Care-MFQ	3.98	.64	-.24***	-.42***	-.11*									
5. Fairness-MFQ	3.80	.64	-.30***	-.54***	-.19***	.56***								
6. Authority-MFQ	2.86	.97	.50***	.43***	.66***	.02	-.04							
7. Loyalty-MFQ	2.68	.87	.36***	.30***	.50***	.12*	.04	.69***						
8. Purity-MFQ	2.44	1.07	.36***	.30***	.69***	.16***	.07	.70***	.60***					
9. Care-MFCT	.75	.13	-.24***	-.33***	-.37***	**.37*****	.22***	-.34***	-.27***	-.28***				
10. Fairness-MFCT	.50	.15	-.47***	-.49***	-.55***	.15***	**.35*****	-.52***	-.39***	-.47***	.20***			
11. Authority-MFCT	.42	.13	.39***	.39***	.52***	-.21***	-.23***	**.59*****	.33***	.41***	-.57***	-.56***		
12. Loyalty-MFCT	.43	.10	.22***	.29***	.19***	-.22***	-.25***	.19***	**.32*****	.10	-.36***	-.42***	.10†	
13. Purity-MFCT	.40	.12	.26***	.32***	.37***	-.18***	-.23***	.25***	.17***	**.38*****	-.43***	-.55***	.17***	-.03

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Political orientation, SDO, and RWA, are on a 1 to 7 scale. MFQ scores are on a 0 to 5 scale, MFCT scores are on a 0 to 1 scale. *p*-values corrected for multiple comparisons (Bonferroni). Correlations between the same foundations on the MFQ and on the MFCT have been highlighted in bold.

SDO was positively associated with authority (β = .09, *SE* = .03, p < .01), and negatively with concerns for care (β = -.44, *SE* = .04, p < .001) and fairness (β = -.56, *SE* = .04, p < .001). However, SDO was not significantly associated with either loyalty (β = .05, *SE* = .04, p = .23) or purity (β = -.04, *SE* = .03, p = .29). RWA was positively associated with loyalty (β = .41, *SE* = .04, p < .001), authority (β = .52, *SE* = .03, p < .001), and purity (β = .69, *SE* = .03, p < .001). However, it was also positively related to concerns for care (β = .12, *SE* = .04, p < .01) and fairness (β = .09, *SE* = .04, p < .05), suggesting that those higher in their endorsement of authoritarianism, also endorsed care and fairness on the MFQ.

The saturated model yielded significant associations between political orientation and loyalty (β = .13, *SE* = .04, p < .001), and authority (β = .20, *SE* = .03, p < .001), but not with care (β = -.07, *SE* = .04, p = .10), fairness (β = -.05, *SE* = .04, p = .18), nor purity (β = .04, *SE* = .03, p = .22).

After adjusting for all other variables in the model, residual variances among foundations remained significantly correlated. The model explained 18.9% of the variance in care, 30.2% in fairness, 26.7% in loyalty, 47.6% in authority, and 47.8% in purity.

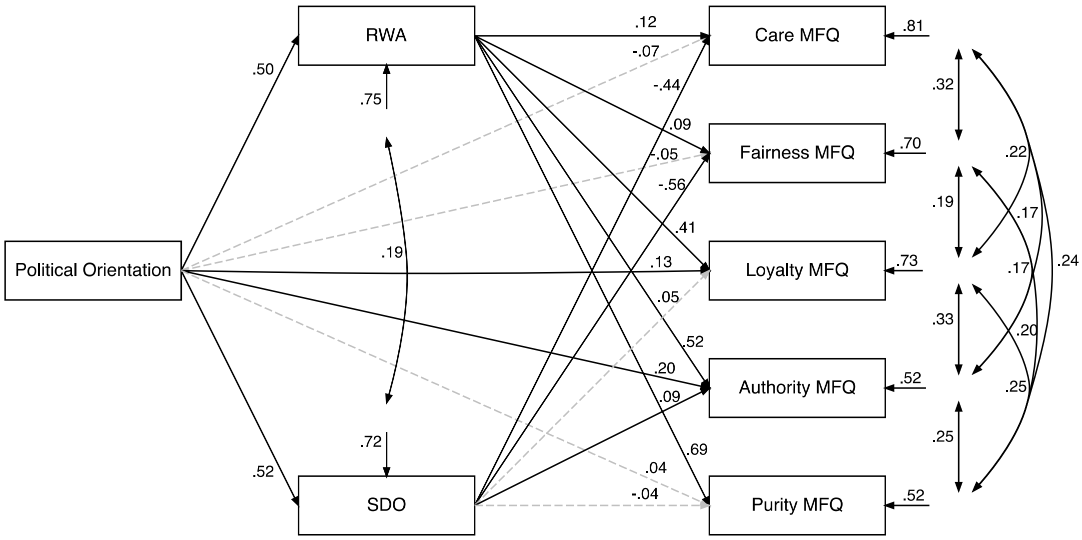

Figure 8.3. Saturated path model showing relationships between political orientation, SDO, RWA, and foundations on the MFQ. Path coefficients are standardised regression coefficients of the full model. Broken lines indicate non-significant paths at p > .05.

Trimmed model

To determine whether direct associations between political orientation and MFQ scores were mediated by RWA and SDO, we trimmed non-significant pathways between SDO and concerns for loyalty and purity. This model is illustrated in Figure 8.4.

The resulting model provided a good fit to the data, TLI = .99 and RMSEA = .04 (Kugler et al., 2014: RMSEA = .02). In the trimmed model, the direct effects of political orientation on concern for loyalty (β = .15, *SE* = .04, p < .001) and authority (β = .20, *SE* = .04, p < .001) remained significant. Thus, liberals were less concerned about loyalty and authority than conservatives even after adjusting for the effects of RWA and SDO.

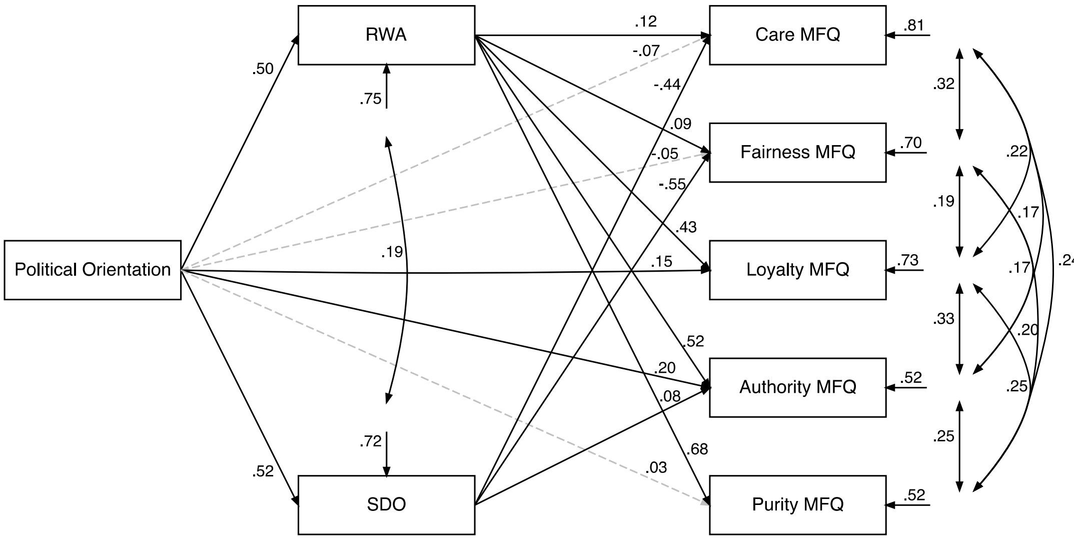

Figure 8.4. Trimmed path model showing SDO and RWA mediate the relationship between political orientation and foundations on the MFQ. Path coefficients are standardised regression coefficients of the trimmed model. Broken lines indicate non-significant paths at p > .05.

Mediation analyses

Table 8.2 shows direct and indirect paths of political orientation on foundations on the MFQ. Indirect paths, and 95% confidence intervals, were estimated by bootstrapping (Kugler et al., 2014; Preacher & Hayes, 2008; Shrout & Bolger, 2002).

As in Kugler et al. (2014), we observed that RWA mediated the effects of political orientation on loyalty, β = .21, *95% CI* [.16, .26], p < .001, authority, β = .26, *95% CI* [.22, .30], p < .001, and purity, β = .34, *95% CI* [.29, .39], p < .001. It also weakly mediated the effects of political orientation on care, β = .06, *95% CI* [.01, .10], p < .05, and fairness, β = .04, *95% CI* [.00, .09], p < .10.

We did not observe mediation effects with all of the binding foundations for SDO, which only weakly mediated the effects of political orientation on authority, β = .04, *95% CI* [.01, .07], p < .01. However, as predicted, SDO did mediate the effects of political orientation on care, β = -.23, *95% CI* [-.28, -.18], p < .001, and fairness, β = -.29, *95% CI* [-.35, -.23], p < .001.

These results, indicate a partial replication of the mediation effects observed by Kugler et al. (2014).

Predicting MFCT scores

Saturated model

We built the saturated model illustrated in Figure 8.5, RMSEA of 0, and TLI of 1. As expected, SDO was positively associated with authority (β = .15, *SE* = .04, p < .001), loyalty (β = .23, *SE* = .04, p < .001), and purity (β = .18, *SE* = .04, p < .001), and negatively associated with care (β = -.22, *SE* = .04, p < .001) and fairness (β = -.24, *SE* = .04, p < .001). RWA was positively associated with the endorsement of authority (β = .40, *SE* = .04, p < .001), and purity (β = .28, *SE* = .04, p < .001). However, it was not associated with loyalty (β = .06, *SE* = .04, p = .18), and was also negatively related to concerns for care (β = -.27, *SE* = .04, p < .001) and fairness (β = -.36, *SE* = .04, p < .001).

Political orientation was negatively associated with fairness (β = -.17, *SE* = .04, p < .001) and positively associated with authority (β = .11, *SE* = .04, p < .01), but associations with all other foundations were not significant (care: β = .01, *SE* = .04, p = .80; loyalty: β = .07, *SE* = .05, p = .14; purity: β = .03, *SE* = .04, p = .49).

After adjusting for other variables in the model, residual variances among foundations on the MFCT remained significantly correlated, with the exception of care and fairness (β = -.05, *SE* = .03, p = .07), and loyalty and authority (β = -.04, *SE* = .03, p = .16). The model explained 17.0% of the variance in care, 39.5% of the variance in fairness, 9.2% of the variance in loyalty, 31.3% of the variance in authority, and 17.0% of variance in purity.

Table 8.2. Direct and indirect effects of political orientation on foundations on the MFQ (Study 5)

	Care		Fairness		Loyalty		Authority		Purity	
	β	95% CI	β	95% CI	β	95% CI	β	95% CI	β	95% CI
Direct effects										
PO → MF	-.07	[-.16, .02]	-.06	[-.13, .03]	$.15^{***}$	[.07, .23]	$.20^{***}$	[.13, .27]	.03	[-.04, .09]
SDO → MF	$-.44^{***}$	[-.52, -.35]	$-.55^{***}$	[-.63, -.48]	–	–	$.09^{**}$	[.03, .14]	–	–
RWA → MF	$.12^{*}$	[.03, .21]	$.09^{*}$	[.00, .18]	$.43^{***}$	[.33, .52]	$.52^{***}$	[.45, .59]	$.68^{***}$	[.62, .74]
Indirect effects										
PO → SDO → MF	$-.23^{***}$	[-.28, -.18]	$-.29^{***}$	[-.35, -.23]	–	–	$.04^{**}$	[.01, .07]	–	–
PO → RWA → MF	$.06^{*}$	[.01, .10]	$.04^{\dagger}$	[.00, .09]	$.21^{***}$	[.16, .26]	$.26^{***}$	[.22, .30]	$.34^{***}$	[.29, .39]
R^2	.19		.30		.27		.48		.48	

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. PO – Political Orientation, MF – Moral Foundations. R^2 signifies the proportion of variance in foundations explained by the trimmed model. Bootstrapped 95% confidence intervals with 5,000 resamples.

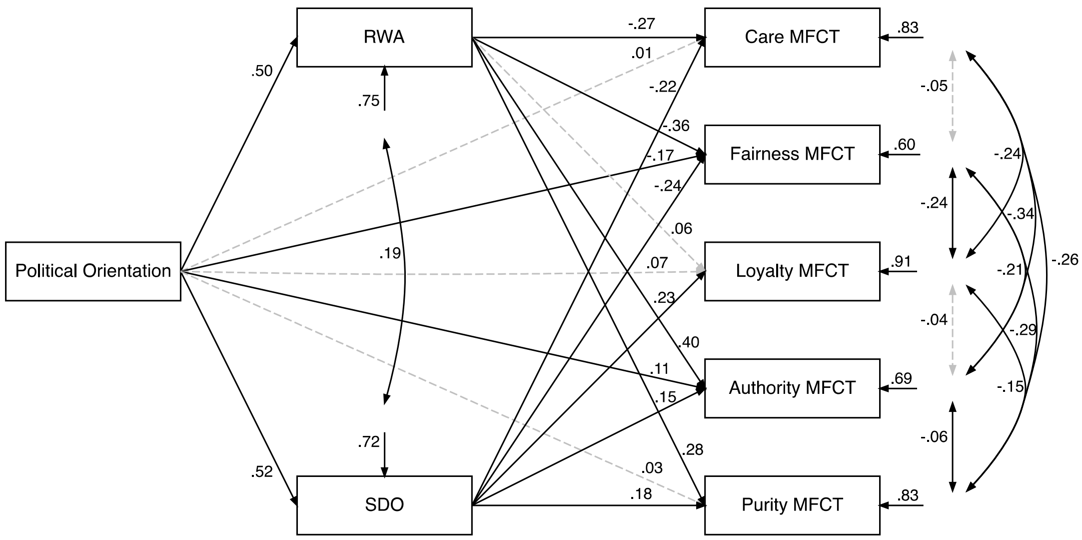

Figure 8.5. Saturated path model showing relationships between political orientation, SDO, RWA, and foundations on the MFCT. Path coefficients are standardised regression coefficients of the full model. Broken lines indicate non-significant paths at $p > .05$.

Trimmed model

We trimmed the non-significant pathways between RWA and concerns for loyalty. This model is illustrated in Figure 8.6.

The resulting model provided a good fit to the data, TLI = 1.00 and RMSEA = .03. In the trimmed model, the direct effects of political orientation on concerns for fairness ($\beta = -.17$, $SE = .04$, $p < .001$), authority ($\beta = .11$, $SE = .04$, $p < .01$), and loyalty ($\beta = .09$, $SE = .04$, $p < .05$) were significant. Thus, liberals were more concerned about fairness, and less about authority and loyalty, than conservatives even after adjusting for the effects of SDO and RWA.

Mediation analyses

Table 8.4 shows direct and indirect paths of political orientation on foundations on the MFCT. As in the above model with MFQ scores and in Kugler et al. (2014), RWA mediated the effects of political orientation on authority, $\beta = .20$, *95% CI* [.16, .24], $p < .001$, and purity, $\beta = .14$, *95% CI* [.10, .19], $p < .001$, but we did not observe the same effects for loyalty. Furthermore, it also more strongly mediated the effects of political orientation on care, $\beta = -.13$, *95% CI* [-.17, -.09], $p < .001$, and fairness, $\beta = -.17$, *95% CI* [-.21, -.13], $p < .001$, than when these were based on MFQ scores.

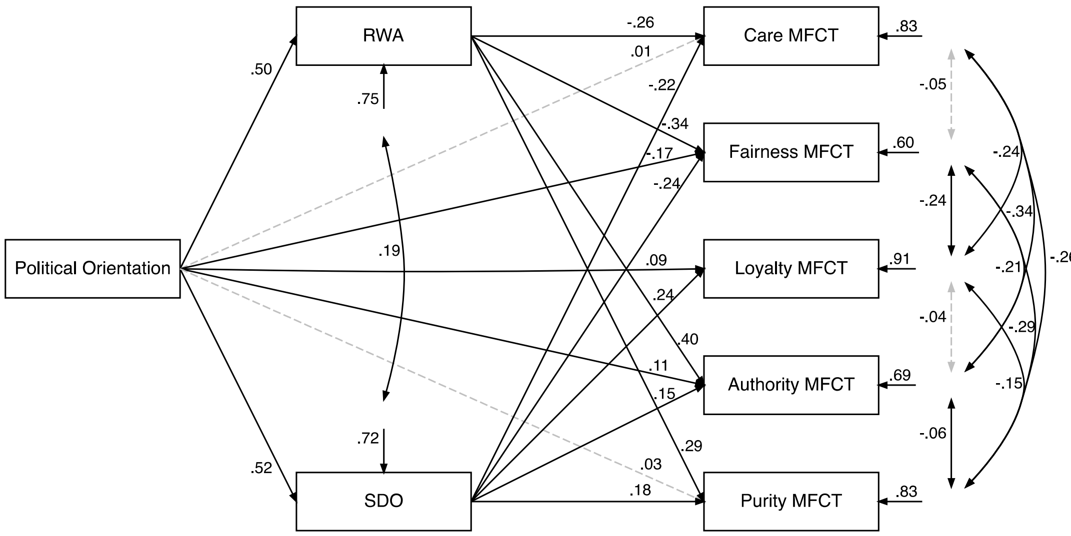

Figure 8.6. Trimmed path model showing SDO and RWA mediate the relationship between political orientation and foundations on the MFCT. Path coefficients are standardised regression coefficients of the trimmed model. Broken lines indicate non-significant paths at *p* > .05.

Also in contrast to the MFQ model, we observed mediation effects with all of the binding foundations for SDO, which mediated the effects of political orientation on loyalty, β = .13, *95% CI* [.08, .18], *p* < .001, authority, β = .08, *95% CI* [.04, .12], *p* < .001, and purity, β = .09, *95% CI* [.05, .14], *p* < .001. However, we did see similar mediation effects for SDO on care, β = -.12, *95% CI* [-.16, -.07], *p* < .001, and fairness, β = -.13, *95% CI* [-.17, -.09], *p* < .001.

These results suggest a closer replication of the mediation effects observed by Kugler et al. (2014), compared to models predicting foundation scores based on the MFQ. Comparing the trimmed models, we found that a model based on MFCT foundation scores has better fit (see Table 8.3).

Table 8.3. Comparison of model fits as indicated by the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC) and Log-Likelihood

Model	AIC	BIC	LogLik
Trimmed MFQ	11225.44	11375.62	-5577.58
Trimmed MFCT	6022.29	6177.03	-2976.25

Note. LogLik is for unrestricted model, MFQ model has 33 free parameters, MFCT has 34 free parameters.

Table 8.4. Direct and indirect effects of political orientation on foundations on the MFCT (Study 5)

	Care		Fairness		Loyalty		Authority		Purity	
	β	95% CI	β	95% CI	β	95% CI	β	95% CI	β	95% CI
Direct effects										
PO → MF	.01	[-.08, .10]	-.17***	[-.25, -.10]	.09*	[.00, .17]	.11**	[.03, .19]	.03	[-.06, .11]
RWA → MF	-.26***	[-.33, -.18]	-.34***	[-.40, -.28]	–	–	.40***	[.33, .47]	.29***	[.20, .37]
SDO → MF	-.22***	[-.31, -.13]	-.24***	[-.32, -.17]	.24***	[.16, .34]	.15***	[.08, .23]	.18***	[.09, .26]
Indirect effects										
PO → RWA → MF	-.13***	[-.17, -.09]	-.17***	[-.21, -.13]	–	–	.20***	[.16, .24]	.14***	[.10, .19]
PO → SDO → MF	-.12***	[-.16, -.07]	-.13***	[-.17, -.09]	.13***	[.08, .18]	.08***	[.04, .12]	.09***	[.05, .14]
R^2	.16		.39		.09		.31		.17	

Note. PO – Political Orientation, MF – Moral Foundations. R^2 signifies the proportion of variance in endorsement of moral foundations explained by the trimmed model. Bootstrapped 95% confidence intervals with 5,000 resamples. † $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$

Exploratory analysis

Mediation models

To explore differences in the variance explained in models based on the MFQ and on the MFCT, we fit two further sets of exploratory models. Here, we regressed MFQ scores on MFCT scores, and vice versa, storing the residuals as new variables. The residuals represent unique variance in MFQ scores not explained by the MFCT, as well as unique variance in MFCT scores not explained by the MFQ, respectively.

Predicting unique variance in MFQ scores

We again built a saturated model (see Figure 8.7). Associations between RWA and care (β = .22, *SE* = .04, p < .01), fairness (β = .22, *SE* = .04, p < .05), loyalty (β = .40, *SE* = .04, p < .001), authority (β = .28, *SE* = .03, p < .001), and purity (β = .58, *SE* = .03, p < .001) remained significant, with associations for care and fairness increasing in strength, relative to their counterparts in the main MFQ model (Figure 8.3), suggesting that the unique variance in MFQ scores for these foundations, not explained by the MFCT, is more strongly positively associated with RWA.

Associations between SDO and care (β = -.36, *SE* = .04, p < .001) and fairness (β = -.47, *SE* = .04, p < .001) also remained significant. However, authority was no longer significantly predicted by SDO, β = -.001, *SE* = .03, p = .98, suggesting that the variance in endorsement of authority that had been explained in the main MFQ model is also captured by the MFCT. Whereas purity had not been significant in the main MFQ model, it was significant in this model in the opposite direction to that we might have expected, β = -.10, *SE* = .03, p < .01, suggesting that SDO predicts unique variance in purity MFQ scores.

Associations between political orientation and loyalty (β = .11, *SE* = .04, p < .01), and authority (β = .13, *SE* = .03, p < .001), remained significant, and became marginally significant for care, (β = -.07, *SE* = .04, p = .07). The model explained 14.3% of the variance in care, 20.0% in fairness, 22.1% in loyalty, 20.4% in authority, and 36.0% in purity.

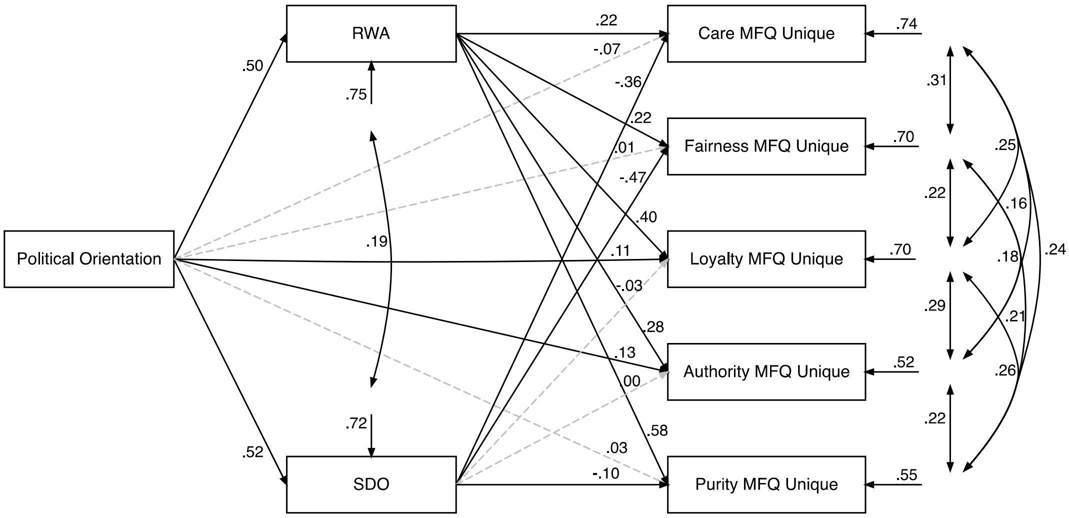

Figure 8.7. Saturated path model showing relationships between political orientation, SDO, RWA, and unique variance in foundations on the MFQ. Path coefficients are standardised regression coefficients of the full model. Broken lines indicate non-significant paths at *p* > .05.

We trimmed the non-significant pathways between SDO and loyalty and authority (see Figure 8.8). The resulting model provided a good fit, TLI = 1.01 and RMSEA = .00. In the trimmed model, the direct effects of political orientation on loyalty (β = .10, *SE* = .04, *p* < .05) and authority (β = .13, *SE* = .03, *p* < .001) remained significant, while care remained marginally significant, (β = -.08 *SE* = .04, *p* = .07).

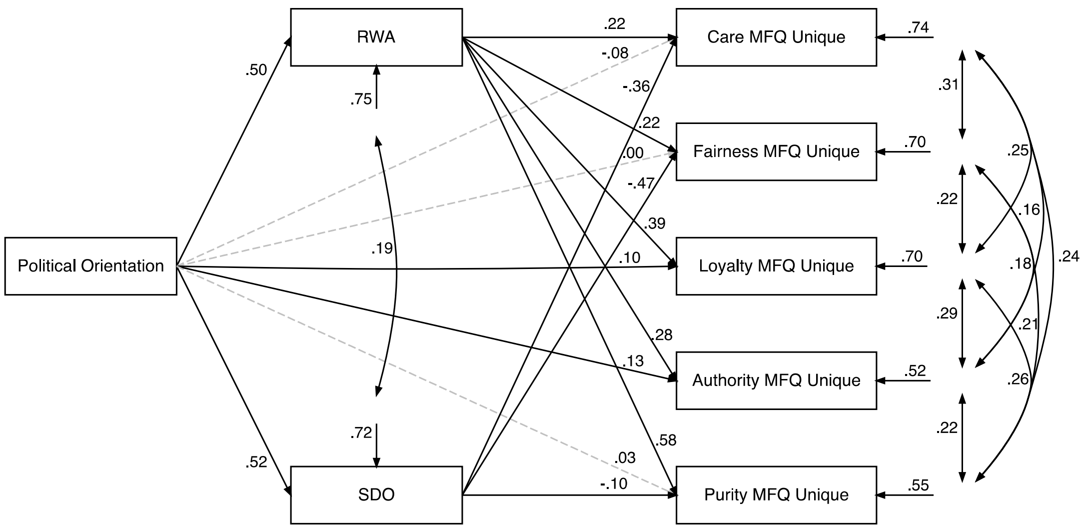

Figure 8.8. Trimmed path model showing relationships between political orientation, SDO, RWA, and unique variance in foundations on the MFQ. Path coefficients are standardised regression coefficients of the full model. Broken lines indicate non-significant paths at *p* > .05.

Table 8.5 shows direct and indirect paths of political orientation on unique variance in foundations on the MFQ. RWA mediated the effects of political orientation on all five foundations, whilst SDO mediated effects on care, fairness, and purity.

Predicting unique variance in MFCT scores

We built a saturated model for unique variance in MFCT scores (see Figure 8.9). SDO remained positively associated with authority (β = .10, *SE* = .04, p < .01), loyalty (β = .21, *SE* = .04, p < .001), and purity (β = .19, *SE* = .04, p < .001), suggesting that the MFCT captures unique variance in the these foundation that is predicted by SDO. However, there were no significant associations between SDO and care (β = -.05, *SE* = .04, p = .18) or fairness (β = -.04, *SE* = .04, p = .23), suggesting that the variance in these foundations predicted by SDO is also captured in the MFQ.

Associations between RWA and care (β = -.32, *SE* = .04, p < .001), fairness (β = -.39, *SE* = .04, p < .001), and authority (β = .09, *SE* = .04, p < .01) remained significant, suggesting that RWA predicts unique variance in MFCT scores for these foundations, not explained by the MFQ. Whereas loyalty had not been significant in the main MFCT model (Figure 8.5), it was marginally significant in this model in the opposite direction to that we might have expected, β = -.07, *SE* = .04, p = .08. However, purity was no longer significantly predicted by RWA, β = .02, *SE* = .04, p = .69, suggesting that the variance in purity that had been explained by RWA is also captured by the MFQ.

The association between political orientation and fairness (β = -.15, *SE* = .04, p < .001) remained significant, but this was not the case for loyalty (β = .03, *SE* = .04, p = .56), nor authority (β = -.01, *SE* = .04, p = .88). The model explained 12.5% of the variance in care, 29.3% in fairness, 4.6% in loyalty, 4.1% in authority, and 5.1% in purity.

We trimmed the non-significant pathway between RWA and purity, and between SDO and care and fairness, and the marginal pathway from RWA to loyalty, (see Figure 8.10). The resulting model provided a good fit, TLI = .99 and RMSEA = .03. In the trimmed model, the direct effects of political orientation on fairness (β = -.17, *SE* = .03, p < .001) remained significant.

Table 8.5. Direct and indirect effects of political orientation on foundations on unique variance in the MFQ (Study 5)

	Care Unique		Fairness Unique		Loyalty Unique		Authority Unique		Purity Unique	
	β	95% CI	β	95% CI	β	95% CI	β	95% CI	β	95% CI
Direct effects										
PO $\rightarrow$ MF	-.08†	[-.16, .01]	.00	[-.08, .09]	.10*	[.02, .18]	.13***	[.07, .20]	.03	[-.04, .10]
RWA $\rightarrow$ MF	.22***	[.13, .30]	.22***	[.13, .30]	.39***	[.30, .48]	.28***	[.22, .35]	.58***	[.51, .64]
SDO $\rightarrow$ MF	- .35***	[-.43, -.27]	-.47***	[-.54, -.39]	–	–	–	–	-.10**	[-.16, -.04]
Indirect effects										
PO $\rightarrow$ RWA $\rightarrow$ MF	.11***	[.07, .15]	.11***	[.06, .15]	.19***	[.15, .24]	.14***	[.11, .17]	.29***	[.24, .34]
PO $\rightarrow$ SDO $\rightarrow$ MF	-.19***	[-.23, -.14]	-.24***	[-.30, -.19]	–	–	–	–	-.05**	[-.08, -.02]
R^2	.14		.20		.22		.20		.36	

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. PO – Political Orientation, MF – Moral Foundations. R^2 signifies the proportion of variance in foundations explained by the trimmed model. Bootstrapped 95% confidence intervals with 5,000 resamples.

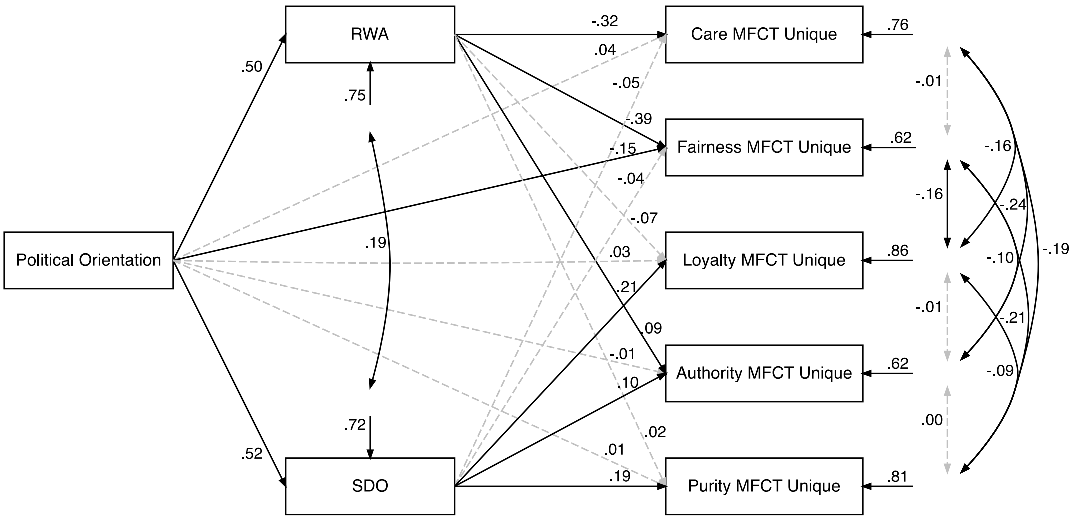

Figure 8.9. Saturated path model showing relationships between political orientation, SDO, RWA, and unique variance in foundations on the MFCT. Path coefficients are standardised regression coefficients of the full model. Broken lines indicate non-significant paths at *p* > .05.

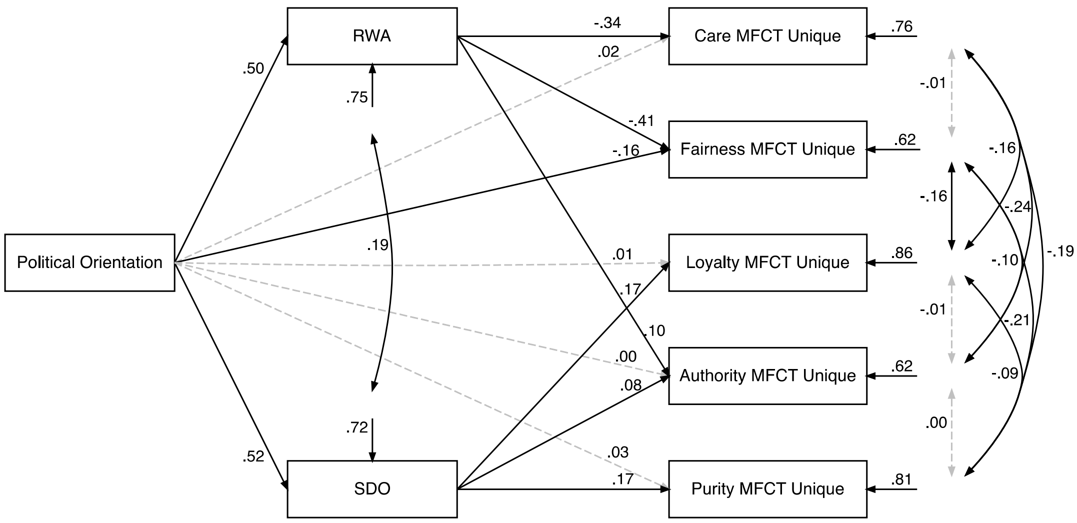

Figure 8.10. Trimmed path model showing relationships between political orientation, SDO, RWA, and unique variance in foundations on the MFCT. Path coefficients are standardised regression coefficients of the full model. Broken lines indicate non-significant paths at *p* > .05.

Table 8.7 shows direct and indirect paths of political orientation on unique variance in foundations on the MFCT. RWA mediated the effects of political orientation on care, fairness and authority, whilst SDO mediated effects on loyalty, authority and purity.

Comparing models of the unique variance in foundation scores measures on the MFQ and MFCT, we see that fit is similar in both models, with slightly better fit for the MFQ model (see Table 8.6). Though fit is similar for the two models, they account for different associations. RWA is associated positively with unique variance in binding foundations in MFQ, but not in MFCT scores. There is a dissociation for individualising foundations, with RWA positively associated in unique MFQ scores, but negatively in MFCT scores. There are also differences in SDO, which is associated negatively with unique variance in individualising foundations in unique MFQ scores, and positively with binding foundations in MFCT scores, with little overlap. These patterns thus suggest that there is systematic non-overlapping variance between the two measures of foundation endorsement.

Furthermore, model fit for unique variance in the MFQ does not change substantially from the full MFQ model, whereas excluding the variance shared with the MFQ worsens fit for the MFCT models. Method variance may provide a partial explanation for this drop in the variance explained by the MFCT. The MFQ has a measurement advantage, being similar in nature to the self-report scales used for political orientation, RWA and SDO. Regardless, and crucially, even after accounting for MFQ variance, the MFCT predicts unique structured relationships in these models.

Table 8.6. Comparison of model fits as indicated by the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC) and Log-Likelihood

Model	AIC	BIC	LogLik
Trimmed MFQ Unique	11192.48	11342.67	-5562.97
Trimmed MFCT Unique	11999.48	12140.56	-5965.68

LogLik is for unrestricted model, MFQ model has 33 free parameters, MFCT has 31 free parameters

Table 8.7. Direct and indirect effects of political orientation on foundations on unique variance in the MFCT (Study 5)

	Care Unique		Fairness Unique		Loyalty Unique		Authority Unique		Purity Unique	
	β	95% CI	β	95% CI	β	95% CI	β	95% CI	β	95% CI
Direct effects										
PO → MF	.02	[-.06, .09]	-.16***	[-.23, -.10]	.01	[-.07, .09]	.00	[-.07, .08]	.03	[-.05, .11]
RWA → MF	-.34***	[-.41, -.27]	-.41***	[-.47, -.35]	–	–	.10**	[.03, .17]	–	–
SDO → MF	–	–	–	–	.17***	[.09, .25]	.08*	[.01, .15]	-.17***	[.10, -.25]
Indirect effects										
PO → RWA → MF	-.17***	[-.21, -.13]	-.20***	[-.24, -.17]	–	–	.05**	[.02, .09]	–	–
PO → SDO → MF	–	–	–	–	.09***	[.05, .14]	.04*	[.00, .08]	.09***	[.05, .14]
R^2	.13		.30		.04		.04		.04	

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. PO – Political Orientation, MF – Moral Foundations. R^2 signifies the proportion of variance in foundations explained by the trimmed model. Bootstrapped 95% confidence intervals with 5,000 resamples.

Political orientation

Preregistered analysis

We preregistered two hypotheses specific to effects of political orientation. We expected that higher conservatism, and thus endorsement of a wider array of foundations, would predict: (a) lower correlations between MFQ and MFCT scores, indicating lower consistency in foundation endorsement; and (b) higher mean RT and τ values in the MFCT, indicating greater levels of conflict across trials. We did not have estimates of the magnitude of these effects.

We fit separate linear regressions to address these predictions (see Table 8.8). Predicting Kendall rank correlation coefficients, we found that, as predicted, the correlation between participants' MFQ and their MFCT scores decreased with higher conservatism, $\beta = -.25$, $p < .001$, indicating decreasing consistency between these two measures of foundation endorsement. There are a number of explanations that might account for this. As more conservative individuals endorse all five foundations as morally relevant, it may be that noise in the MFCT systematically increases, making foundation rankings on the MFCT less reliable. However, it may also be that, by pitting foundations against one another, the MFCT is capturing unique variance in foundation endorsement that is more apparent when individuals have more endorsed moral values. A third, and related, possibility is that more conservative individuals are simply more morally inconsistent across these kinds of choices. These analyses are unable to disentangle these alternatives.

Contrary to our prediction, more conservative participants tended to have marginally lower mean RT, $\beta = -.06$, $p < .10$, and significantly lower mean τ, $\beta = -.11$, $p < .001$, suggesting that they experience less conflict in decisions between foundations on the MFCT. This might indicate that more conservative individuals endorse all five foundations as morally relevant, and therefore find decisions between them less difficult, rather than more difficult. However, it may also be a result of other mechanisms that quickly resolve these kinds of moral judgments. We will return to these points in the discussion of this study and in the general discussion (see Chapter 9).

Table 8.8. Predicting correlation coefficients between MFQ and MFCT, and RT and τ on the MFCT, from political orientation for Study 5

	Models		
	Correlation coefficient (r_τ)	log RT	log τ
Intercept	-.00 (.04)	-.00 (.04)	-.00 (.04)
Political Orientation	-.25*** (.04)	-.06† (.04)	-.11** (.04)
R^2	.06	.004	.01
Adj. R^2	.06	.003	.01
Residual *SE* (df = 698)	.97	1.00	.99
F (1, 698)	46.80***	2.83†	8.34**

Note. † *p* < .10, * *p* < .05, ** *p* < .01, *** *p* < .001. Number of observations = 700. Separate models predicting correlation coefficient (r_τ) between the MFQ and the MFCT, and log RT and log τ on the MFCT. All variables have been standardised. *SE* is provided in parentheses.

Predicting RT on the MFCT

Preregistered analysis

As observed in previous studies, we predicted that differences in foundation endorsement, measured both on the MFQ and on the MFCT itself would predict greater conflict in decisions between closely-valued foundations, as measured by mean RT scores and fitted τ parameters, but not necessarily in μ. We anticipated that these effects would be small for models based on MFQ scores, and small to moderate for models based on MFCT scores.

To test these predictions, we preregistered a number of analyses that operationalise the difference in value between foundations in a number of ways, and replicate the RT analyses conducted in other studies. Firstly, we built a multilevel model predicting RT from both a linear and quadratic term of difference in standardised MFQ and MFCT scores between foundations. Secondly, we fit within-subject Ex-Gaussian parameters to RT distributions based on how many ranks apart foundations in each trial are based on each participant's rank order of MFQ and MFCT scores, and fit two sets of multilevel models predicting RT, τ, and μ.

Difference in foundation scores predicting RT

Separate multilevel models (see Table 8.9) were fit to predict RT from the difference between MFQ and MFCT scores, entered into the models as both linear (x) and quadratic (x_2) terms, predicting that RT will be highest when the difference is 0 indicating that two foundations are equally valued, and that the effect on RT would be non-linear. Figure 8.11 plots these quadratic regressions.

For these models, both linear, βs = -.04, ps < .001, and quadratic terms, βs > |.01|, ps < .01, were significant and in the predicted direction. In previous the studies with smaller samples, we had found (with the exception of Study 3) that the linear term, but not the quadratic, was significant when difference is based on MFQ scores, and vice versa for a difference in MFCT scores. As in previous studies, these effects are small.

Table 8.9. Predicting RT from difference in MFQ and MFCT scores for Study 5

	Models	
	log RT	
Fixed effects		
Intercept	.06* (.02)	.11*** (.03)
Difference in MFQ Scores	-.04*** (.01)	
Difference in MFQ Scores^2	-.01** (.003)	
Difference in MFCT Scores		-.04*** (.01)
Difference in MFCT Scores^2		-.02*** (.003)
Random effects		
By Subject - σ		
Intercept	.63	.64
Foundation Combination	< .001	< .001
Valence	< .001	< .001
Action	.34	.33
Residual	.70	.70
Marginal R^2 / Conditional R^2	.004 / .52	.01 / .52
LogLik	-129,617	-129,152
AIC	259,251	258,319
BIC	259,328	258,396

Note. † p < .10, * p < .05, ** p < .01, *** p < .001. Number of observations = 111,709. Fixed and random effects for separate models predicting log RT. Outcome variables have been standardised.

Quadratic models fit terms for difference in scores (x) and squared difference in scores (x^2) between foundations in a trial. In order to preserve a minimum value of 0 interpretable as no difference between scores for the quadratic term, difference predictors in these models were scaled by SD without centring. For fixed effects, *SE* is provided in parentheses. Models that included a random intercept for item pairings failed to converge and this term was thus excluded.

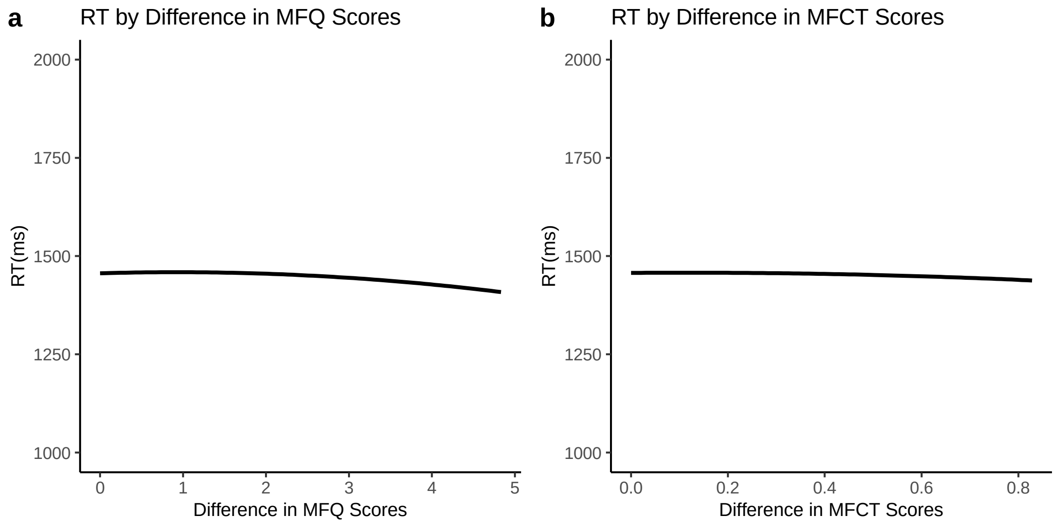

Figure 8.11. Predicting RT for Study 5 with quadratic models for (a) difference in MFQ scores and (b) difference in MFCT scores between foundations in a trial. Grey areas represent 95% CI boundaries.

Ranks apart predicting RT

As in previous studies, we applied Ex-Gaussian decomposition of RT distributions from the MFCT, based on how many ranks apart foundations in each trial are, based on either MFQ or MFCT scores. A total of 316 participants had equally scored foundations on the MFQ, and 145 had equally scored foundations on the MFCT. Figure 8.12 and Figure 8.13 show histograms for within-subject mean RTs, μ and τ calculated for ranks apart categories based on the MFQ and MFCT, respectively.

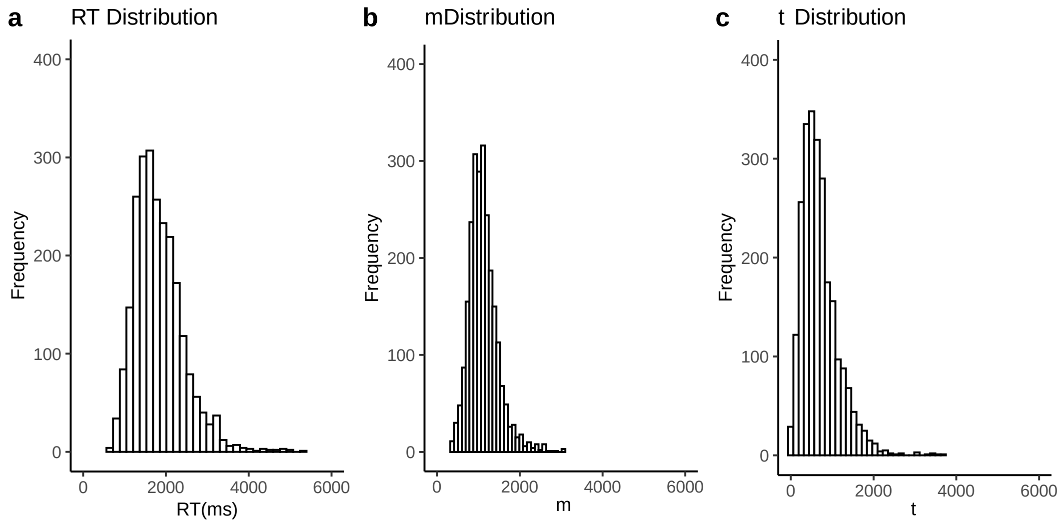

Figure 8.12. Distribution of RT (a), μ (b) and τ (c) across MFQ rank apart categories in Study 5

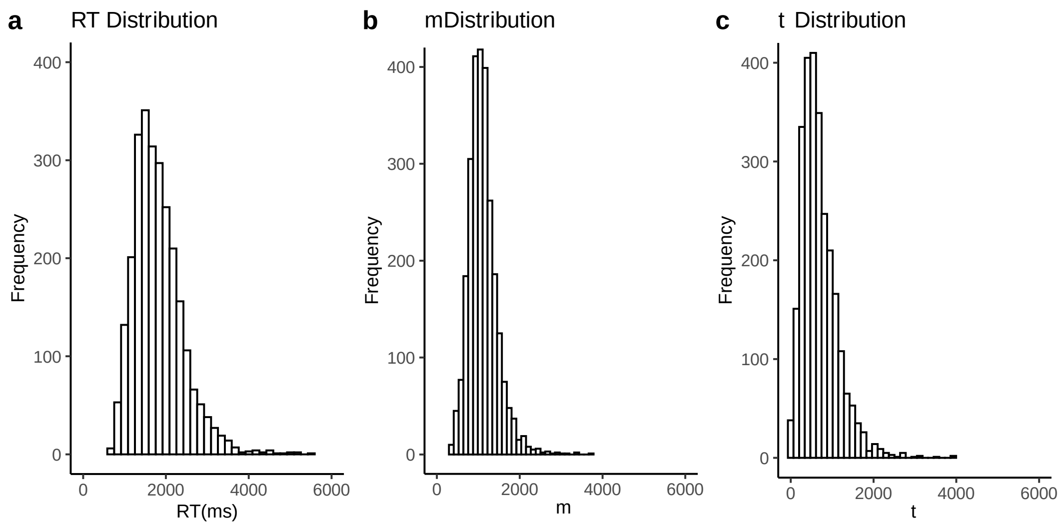

Figure 8.13. Distribution of RT (a), μ (b) and τ (c) across MFCT rank apart categories in Study 5

We predict that it would take longer and be more difficult to choose between foundations fewer ranks apart (i.e. more closely matched in value), and as such that fewer ranks apart will result in greater overall RT and τ, as a measure of decision conflict. Multilevel models were fit to predict RT, μ and τ from ranks apart based on the MFQ and the MFCT, with a set of planned contrasts (Helmert coding), testing whether the former increases with fewer ranks apart (see Table 8.10). In contrast to previous studies with smaller samples, we included equally valued choices (0 ranks apart). These had previously been dropped due to infrequent occurrence, and thus high error.

Ranks apart on MFQ

For choices between closely valued foundations, based on rank order on the MFQ, we would expect longer RTs and greater τ, but not necessarily greater μ. Decreasing trends in RT and τ, and partially in μ, can be seen as the number of ranks apart increases (see Figure 8.14). This decreasing trend was significant for mean RT in all comparisons, βs > .10, *p*s < .001, and in one, two and three rank apart choices in τ, βs > .09, *p*s < .05, relative to further apart choices. μ was higher in equally valued, and one rank apart choices, βs > .07, *p*s < .01, relative to further apart choices, but this trend was not significant for other comparisons, βs = .03, *p*s > .10. Unlike in mean RT and μ, τ was lower in equally valued choices, β = -.13, p < .01, relative to further apart choices, indicating lower conflict in these choices.

Ranks apart on MFCT

Decreasing trends in RT and τ, as well as in μ, have larger effects for ranks apart based on the MFCT itself (see Figure 8.15). As for ranks based on the MFQ, this decreasing trend was significant for mean RT in all comparisons, βs > .16, *p*s < .001, and in one, two and three rank apart choices in τ, βs > .20, *p*s < .001, relative to further apart choices. Unlike when based on the MFQ, τ was not higher in equally valued choices on the task, β = -.01, p > .10. μ was also higher in equally valued, one, and two rank apart choices, βs > .09, *p*s < .01, relative to further apart choices.

Table 8.10. Predicting RT, μ and τ from ranks apart on the MFQ and MFCT for Study 5

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	-.02 (.04)	.004 (.03)	-.03 (.03)	.03 (.04)	.04 (.03)	-.02 (.03)
Ranks Apart						
0 RA v. 1, 2, 3, 4	.13*** (.02)	.20*** (.03)	-.13** (.04)	.25*** (.02)	.27*** (.05)	-.01 (.06)
1 RA v. 2, 3, 4	.14*** (.01)	.07** (.02)	.19*** (.03)	.21*** (.01)	.15*** (.02)	.20*** (.03)
2 RA v. 3, 4	.13*** (.01)	.03 (.03)	.20*** (.03)	.20*** (.01)	.09*** (.02)	.23*** (.03)
3 RA v. 4	.10*** (.02)	.03 (.03)	.09* (.04)	.16*** (.01)	.04 (.03)	.25*** (.04)

Random effects						
By Subject - σ						
Intercept	.97	.87	.75	.96	.87	.76
Residual	.26	.51	.65	.25	.48	.64
Marginal R^2 / Conditional R^2	.01 / .94	.01 / .74	.01 / .57	.02 / .94	.01 / .77	.02 / .60
LogLik	-1,560	-2,914	-3,353	-1,539	-2,842	-3,366
AIC	3,135	5,843	6,719	3,091	5,698	6,746
BIC	3,176	5,884	6,761	3,133	5,739	6,788

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 2,738 (MFQ) and 2,793 (MFCT). RA – Ranks Apart. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. Helmert coding compares each rank apart category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

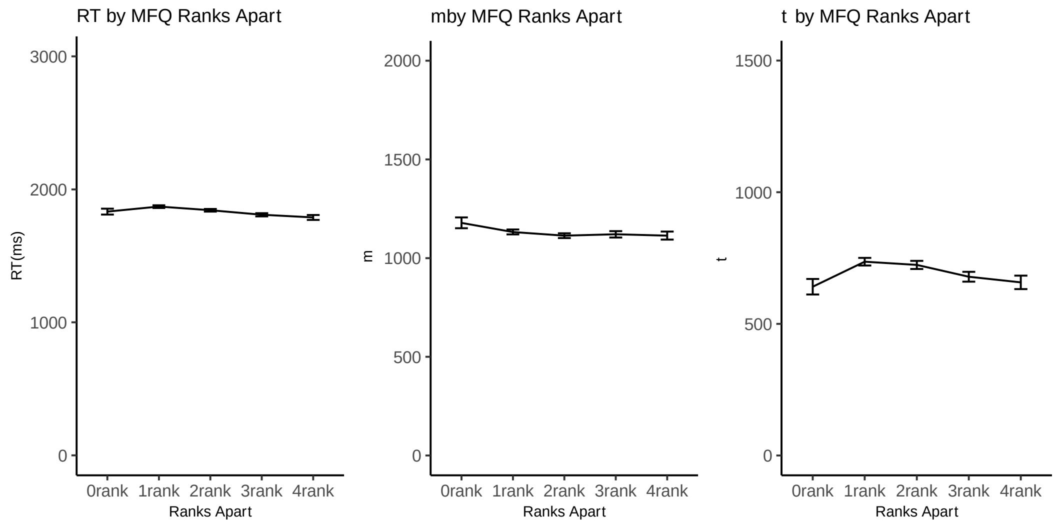

Figure 8.14. Ranks apart on MFQ predicting RT (a), μ (b) and τ (c) for Study 5. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

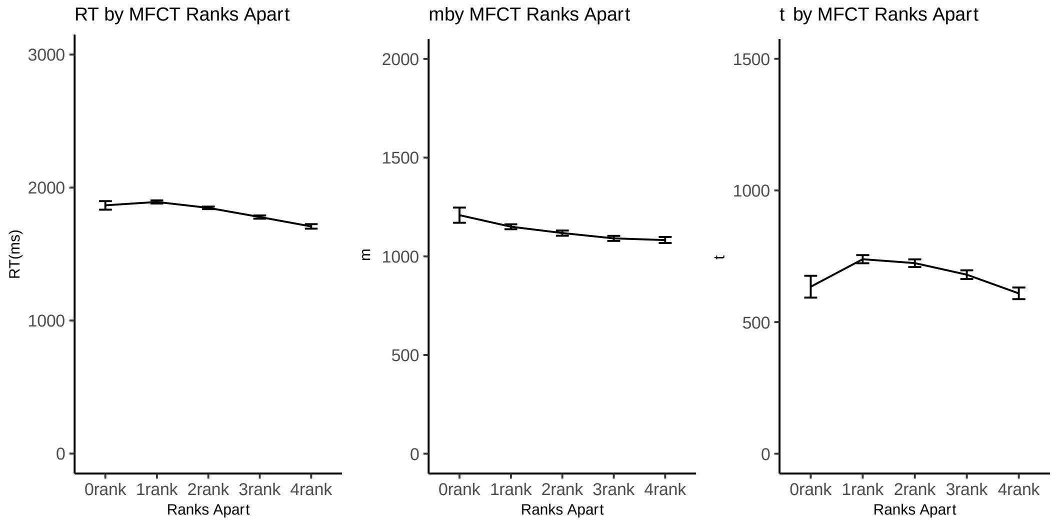

Figure 8.15. Ranks apart on MFCT predicting RT (a), μ (b) and τ (c) for Study 5. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

These analyses replicate those in previous studies, indicating that foundation endorsement/preference is reflected in RTs on the MFCT, and that this tracks expected conflict in decisions between more closely valued foundations. With a larger sample size, these patterns are less noisy, and are also apparent, but to a lesser extent, in μ, as an indicator of the time required to physically make responses.

In addition, a larger sample size allows us to include choices between equally valued foundations. Here, we see higher μ, but lower τ, suggesting that though longer time required to physically make these choices, they incur lower conflict. However, this dissociation is only significant when ranks are based on the MFQ, and thus its implications for the cognitive processes of conflict resolution involved in the MFCT task are questionable.

Exploratory analysis

The above ways of operationalising the difference in value between foundations do not account for *how much* value is placed on each foundation, and therefore, as for previous studies, we ran a number of exploratory analyses attempting to better account for this. We report all these analyses in Appendix 4. Here, we present models based on weighted ranks apart as the clearest means of accomplishing this based on the preceding studies.

Weighted ranks apart predicting RT

We fit models to include a bias term for the ranks in a choice, calculated as $mean(Rank_1, Rank_2)$, to weight the number of ranks apart foundations are in each trial. As in previous studies, ranks were reversed, so that the most valued foundation ranks as 5, and the least valued ranks as 1, so that a higher mean rank for foundations in a choice indicates higher value.

Models (see Table 8.11) tested effects for the bias term for the mean rank of foundations in a given trial, their ranks apart, and the interaction between these. For ranks based on both MFQ and MFCT scores, RT is negatively predicted by mean rank, βs < -.07, ps < .001, and by number of ranks apart, βs < -.04, ps < .001, indicating that as the value, and the difference in value, of foundations in a choice increases, time to make the choice decreases. There was no evidence of an interaction between these for ranks based on the MFQ, β = .004, p > .10. However this interaction was significant for ranks based on the MFCT, β = -.03, p < .001.

Table 8.11. Predicting RT from mean rank and ranks apart on the MFQ and MFCT for Study 5

	Models	
	log RT	
	MFQ	MFCT
Fixed effects		
Intercept	-.001 (.02)	-.002 (.02)
Mean Rank	$-.07^{***}$ (.004)	$-.09^{***}$ (.004)
Ranks Apart	$-.04^{***}$ (.003)	$-.07^{***}$ (.003)
Mean Rank : Ranks Apart	.004 (.004)	$-.03^{***}$ (.005)
Random effects		
By Subject - σ		
Intercept	.62	.63
Foundation Combination	< .001	< .001
Valence	< .001	< .001
Action	.34	.33
Residual	.70	.70
Marginal R^2 / Conditional R^2	.01 / .51	.01 / .51
LogLik	-129,450	-129,165
AIC	258,919	258,348

BIC	259,005	258,435

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 111,709. Fixed and random effects for separate models predicting log RT. Outcome variables and predictors have been standardised. Mean rank calculated as *mean*($Rank_1$, $Rank_2$), of reversed ranks, such that higher mean rank indicates more valued foundations. For fixed effects, *SE* is provided in parentheses.

8.2.3 Discussion

The preceding studies have relied on student samples, and thus these samples were likely to be politically liberal. In contrast, this study uses a larger, and more politically and morally diverse, general sample. Thus, we further consolidate support for the MFCT as a stable and reliable measure of intuitive preferences for foundations, finding a correlation between the MFCT and MFQ, of similar magnitude to that observed in previous studies ($r_\tau = .47$). We also replicate previous evidence of expected patterns of conflict in analyses of RT.

Moreover, in this study, we sought to test the external validity of the MFCT, directly comparing its performance against that of the MFQ. To do this, we replicated a mediation model (Kugler et al., 2014) that predicts foundation endorsement on the MFQ from three well-established correlates – political orientation, right-wing authoritarianism, and social dominance orientation. We find that the MFCT produces associations with these variables in line with our predictions, and relative to models fit to foundations measured on the MFQ, explains more variance. Furthermore, we show that removing variance shared by the two measures, foundation preferences on the MFCT account for unique structured relationships with these variables that are distinct from those uniquely explained by the MFQ. In doing so, it is worth noting that the MFCT is overcoming a method disadvantage in that, unlike the MFQ, it is a different kind of measure than the scales used for these variables. Furthermore, we found that more conservative individuals had less consistency between their MFCT and MFQ foundation preferences, but also had – in contrast to our expectations – less conflict evident in their response times.

These findings highlight the contribution that the MFCT, in the way it measures moral foundations, can make to literature on ideological differences in moral judgment. They demonstrate the potential to explore differences in cognitive processes more directly than has previously been carried out (see Chapter 2.3). Though right-wing authoritarianism and social dominance orientation are often measured and discussed as individual difference measures of stable traits, they are also differences in cognitive style and processing that are theorised to motivate political conservatism (e.g. Jost et al., 2003; Van Leeuwen & Park, 2009), and are likely subject to similar kinds of cultural and social learning as foundations (e.g. Graham et al., 2013; Haidt & Joseph, 2004, 2007). The MFCT has been developed to tap into different, though related, cognitive mechanisms than those which underlie explicit self-reported responses on the MFQ, and we expect that this may account for some of the differences in their respective contributions in this study. Further to this, our findings regarding political orientation serve to crystallise a number of pertinent questions about the link between ideology and moral foundations, arising from these underlying processes, that we are unable to clarify in this study. These implications are further explored in a general discussion (see Chapter 9.2).

9 Chapter 9: General Discussion

In this thesis, we sought to develop and validate a novel task designed to capture intuitive preferences for moral foundations, as they come into conflict with one another. In doing so, we demonstrate the value of exploring such intuitive conflicts in order to address theoretical and methodological gaps – and inform debate – in a literature that tends to measure foundations in isolation. Thus, in Chapter 3, we present the Moral Foundations Conflict Task – the MFCT – a forced-choice, trade-off task that requires quick and intuitive choices between foundations, that tracks preferences based on how often they are chosen, and how long it takes to choose them. To validate this task, we pit it against the Moral Foundations Questionnaire (Graham et al., 2011), as the widely accepted, and widely used, standard of measurement.

In Chapter 5, we showed that the self-reported and explicit endorsements of moral foundations measured in the MFQ are reflected in the intuitive foundation preferences on the MFCT, correlating at $r_\tau = .50$. We find that this association is stable across further studies in Chapters 6 to 8 ($.47 < r_\tau < .61$). In Chapter 6, we tested our claim that the MFCT is an intuitive level of measurement by exploring whether this association with the MFQ would shift under cognitive load. Here, we found that foundation preferences measured on the MFCT are not altered under two manipulations of cognitive load. We take this as evidence that the quick choices on the MFCT are the result of decision processes that resolve intuitive-level conflict between foundations. In Chapter 7, we manipulated attention in the other direction, and found that foundation preferences on the MFCT also do not shift when participants were instructed to deliberate their choices. However, our interpretation of these findings is hindered by the limitations of this study discussed in this chapter. Finally, in Chapter 8, we showed that foundation preferences on the MFCT replicate well-established associations between foundations measured on the MFQ and three key corelates – left-right political orientation, right-wing authoritarianism, and social dominance orientation. Here, we showed that a model fitting responses on the MFCT not only replicates, but outperforms, a model fit to MFQ responses, evidencing that the MFCT captures unique and non-overlapping variance. To further probe our assumptions about the task, we conducted exploratory analyses of response times, applying an Ex-Gaussian approach alongside analyses of mean RT. Ex-Gaussian decomposition isolates a τ parameter in RT distributions that corresponds to conflict resolution in decision processes (Heathcote et al., 1991; Luce, 1986; McGill, 1963). Across Chapters 5 to 8, we find that both mean RT and τ generally decrease as the value – measured on both the MFQ and on the task itself – of the foundations in a choice increases, and these choices become less difficult. Though these effects are consistently small, we take this as support that the MFCT is tapping into intuitive-level conflict.

Taken together, we believe that the empirical work laid out in this thesis provides sufficient evidence to conclude that our task – the MFCT – is a stable and reliable measure of intuitive inter-foundation conflicts, and makes a unique contribution – separate to that of the MFQ – in capturing preferences for moral foundations. In the following discussion, we expand on key contributions, and identify limitations and future directions of this research.

9.1 Contributions

We identify four key contributions of this work that are jointly theoretical and methodological. Firstly, it develops the MFCT as the first way to systematically trigger and measure intuitive preferences for moral foundations *when in conflict with one another*. Secondly, it validates this task against the criterion measure in the literature on moral foundations, the MFQ. Thirdly, it shows that the MFCT is stable over multiple manipulations that are directly relevant to the claims of an intuitive level of measurement, enhancing confidence in its construct validity. Finally, it demonstrates that the task makes a unique, and substantive, contribution in capturing foundation preference that is separate from that of the MFQ.

9.1.1 Intuitive moral foundation conflicts

Moral foundations are theorised as multiple, distinct and differentially-activated moral intuitions that drive our moral judgments, beliefs and actions (Haidt & Joseph, 2007). If this is the case, then these moral intuitions may dynamically compete, as they come into conflict with one another, and we might expect that this conflict is systematically related to our deliberated moral values. To the best of our knowledge, this question has never been directly addressed. While MFT literature suggests that foundation-relevant intuitions and emotions can be manipulated (Horberg et al., 2009; Inbar et al., 2009; Schnall, Benton, et al., 2008; Schnall, Haidt, et al., 2008; Wheatley & Haidt, 2005; Zhong et al., 2010), and thus that situational factors can differentially trigger moral foundations, even within individuals, it does not make attempts to isolate the inter-foundation conflicts that might inform such effects. Nor has this question been addressed in the wider moral literature. A wide variety of work on dual-process models of morality (Crockett, 2013; Cushman, 2013; Cushman & Greene, 2012; Greene et al., 2004; Haidt, 2001; Kahane, 2012; Moore et al., 2008; Moore et al., 2011) has predicted why, and when, instances of cognitive conflict arise in moral judgments, and how that conflict may be resolved by engaging deliberative and reflective processes. However, relatively little is understood about whether conflict between moral intuitions might occur and be resolved *at the intuitive level*, prior to the recruitment of deliberative and reflective cognition. Instead, foundations as moral intuitions have typically been conceived of as co-existing in parallel (e.g. Haidt, 2001), with any conflict arising between them being resolved through reasoned and deliberate reflection. Thus, conflict detection and resolution are often defined as strictly System 2-type processes.

We are not applying this definition of moral conflict in this research. Instead, we operationalise conflict between moral foundations by measuring preferences for foundations when they are pitted against one another in quick intuitive judgments. In doing so, we rely on speed as one of several aspects of intuitive judgment in the literature on dual-process models (e.g. Evans & Stanovich, 2013; Greene et al., 2001; Haidt, 2001; Kahneman, 2011). This focus on quick judgments allows us to tap into the relative 'strengths' of foundation intuitions directly, by minimising the role of deliberation and System 2 processes in these judgments. As such, our claim is not that the resolution of conflict between moral foundations occurs *only* – or even mostly – at the intuitive-level. Neither do we claim that conflict resolution captured in the MFCT always occurs at the intuitive-level (we include discussion below of future work that may determine the mechanisms underpinning decisions in the task and thus distinguish between instances of more intuitively versus more reflectively driven choices). Instead, we seek to demonstrate that intuitive conflict between moral foundations can be meaningfully triggered and measured.

We contrast our approach to the widely accepted approaches of asking participants to report how important each foundation is in isolation, as on the MFQ

(Graham et al., 2011), or by triggering the intuitive base of individual foundations (Horberg et al., 2009; Inbar et al., 2009; Schnall, Benton, et al., 2008; Schnall, Haidt, et al., 2008; Wheatley & Haidt, 2005; Zhong et al., 2010). We also contrast our approach with (the few) previous foundation trade-off approaches that either take a composite of two foundations measured individually (Monroe & Plant, 2018, Studies 1 & 2; Waytz et al., 2013, Study 1), or isolated foundations in trade-offs against non-moral goods (Graham et al., 2009, Study 3; Monroe & Plant, 2018, Study 3). One exception is a task used by Graham (2010, Study 2) that does capture trade-offs between foundations in similar dyads to those used in the MFCT. However, this task was not intended to be a psychometrically valid measure of inter-foundation conflicts themselves, and is instead applied to explore ideological differences in intuitive foundation responses. It includes only active foundation violating/vice behaviour. In contrast, and to address prior asymmetries in a literature that tends to maintain this focus (e.g. Clifford, Iyengar, Cabeza, & Sinnott-Armstrong, 2015; Garvey & Ford, 2014; Graham et al., 2009, Study 3; Landy, 2016; Royzman et al., 2014; Schein & Gray, 2015), the MFCT includes both vices and virtues, and both active and passive formulations of foundations. Overall the MFCT remains stable across these formulations, and can be analysed at the global level, enhancing confidence in its content validity in covering multiple facets of foundation intuitions.

In sum, the first major contribution of this research is in showing that intuitive inter-foundation conflicts can be triggered and effectively measured, and are reliably related to deliberated endorsements of foundations.

9.1.2 Validation against the Moral Foundations Questionnaire

The MFQ was developed as an individual differences measure of the first five foundations in the theoretical framework of MFT (Graham et al., 2011), and its earliest, and most common, application, is in testing a key hypotheses about ideological differences in foundation endorsement (Graham, 2010; Graham et al., 2013; Graham et al., 2009; Haidt & Graham, 2007). This hypothesis predicts that intractability of ideological disputes is explained by differences in patterns of the five foundations: liberals focus on individualising foundations of care and fairness, while conservatives place emphasis on all five foundations, including the binding foundations of authority, loyalty and purity (Graham, 2010; Graham et al., 2009; Haidt & Graham, 2007).

However, this hypothesis, and the five-factor structure it relies on, is contested on multiple fronts (Jacobsin, 2008; Jost, 2012; Kugler et al., 2014; Schein & Gray, 2015, 2018). Thus, the internal and external validity of the MFQ has been closely connected to the internal validity of the MFT model itself.

In this regard, there is strong support for the validity of the MFQ as a measure of five, distinct, moral foundations. In large samples, Graham et al. (2011) found that five-factors fit better than alternative three-factor, two-factor and single factor models, and the five-factor model has been replicated in both WEIRD (Davies et al., 2014; Métayer & Pahlavan, 2014; Nilsson & Erlandsson, 2015) and non-WEIRD (Berniūnas et al., 2016; Yilmaz, Harma, et al., 2016; Zhang & Li, 2015) cultures, and is stable (Doğruyol et al., 2019). However, a number of studies find that the five-factor structure is a poor fit in non-WEIRD contexts (Davis et al., 2016; Yalçındağ et al., 2017) and does not cross-culturally replicate (Iurino & Saucier, 2020), or advocate a two-factor structure instead (Napier & Luguri, 2013; Van Leeuwen & Park, 2009; Wright & Baril, 2011; Yilmaz, Harma, et al., 2016). As such, there has been sufficient contradictory evidence on the structure of moral foundations to fuel debate, and some of this debate is tied to measurement properties of the MFQ. Furthermore, a lot of this debate centres on whether these five factors correspond to five distinct kinds of 'moral' intuition (e.g. Jost, 2012; Kugler et al., 2014; Schein & Gray, 2015, 2018), posing important theoretical questions about the intuitive base of moral judgment. The MFQ is an explicit self-report measure, and thus is unable to adequately address to these questions.

In this research, we develop the MFCT as a task that maps intensities of moral intuitions by measuring them in conflict with one another. In doing so, it provides indices of individual differences in intuitive foundation preferences that can be directly compared to the MFQ. We find that patterns of foundation endorsement on the MFCT and MFQ are reliably and stably associated, though not perfectly matched. We then show that, rather than indicating the MFCT presents a noisy measure of foundations better measured by the MFQ, this mismatch indicates systematic and non-overlapping variance between the two measures, by demonstrating that the MFCT independently predicts established correlates of the MFQ. Thus, this research provides a validated tool of foundation preferences, that compares favourably with the best established measure in the literature.

9.1.3 An intuitive-level measure of moral foundations

MFT is fundamentally an intuitionist theory of morality, and thus evidence for distinct foundation intuitions is crucial. Several methods have been previously used to evidence the intuitive bases of foundations. However this literature is marked by three limitations that hinder its ability to address questions about the nature of distinct foundation intuitions. Firstly, it either tends to focus on implicitly triggering or manipulating single foundations, and has overwhelmingly focused on purity (Horberg et al., 2009; Inbar et al., 2009; Schnall, Benton, et al., 2008; Schnall, Haidt, et al., 2008; Wheatley & Haidt, 2005; Zhong et al., 2010). This approach is unable to address questions about how multiple foundation intuitions operate, and may also be vulnerable to concerns about the robustness of social priming effects (Doyen et al., 2012; Schimmack et al., 2017; Shanks et al., 2013). Secondly, it tends to rely on manipulating cognitive resources or style, and then testing effects on explicitly-reported foundations (Garvey & Ford, 2014; Napier & Luguri, 2013; Pennycook et al., 2014; Royzman et al., 2014; Van Berkel et al., 2015; Van de Vyver et al., 2016; Wright & Baril, 2011; Yilmaz & Saribay, 2017a). This approach is not directly measuring foundation intuitions, and remains reliant on explicit self-report. Thirdly, it tends to explore foundation intuitions primarily as a means of addressing hypotheses about ideological differences (Garvey & Ford, 2014; Graham, 2010; Haidt & Graham, 2007; Wright & Baril, 2011).

In the context of this third point, this literature has conflicting answers to questions about which foundations have distinct, moral, intuitive bases, and how these might relate to explicit foundations. There are cases for, against, each of three contradictory claims about ideological differences in intuitive foundations: (1) that these appear at both intuitive and explicit levels (e.g. Graham et al., 2009); (2) there are universal intuitions based on all five foundations, and liberals selectively correct for those that are inconsistent with their explicit values (e.g. Skitka et al., 2002); or (3) there are universal intuitions based on foundations of care and fairness, but conservatives selectively enhance the importance of binding foundations to satisfy other ‘non-moral’ motives (e.g. Wright & Baril, 2011). The majority of this work is also subject to the second limitation discussed above, either manipulating cognitive load (e.g. Van Berkel et al., 2015; Wright & Baril, 2011) or analytic and reflective thought (e.g. Napier & Luguri, 2013; Yilmaz & Saribay, 2017a) and measuring effects on explicit foundation judgments. In a set of studies that more directly target intuitive-level foundations, Graham (2010) found that, in general, liberals and conservatives differ at the intuitive-level in the same directions that they differ in explicit foundations, but that liberals also had automatic responses to all foundations similar to that of conservatives, reconciling elements of both proposals (1) and (2). However, this approach too, explores foundation intuitions through political ideology. There may be means of reconciling elements of all three proposals. Work on 'morality shifting' (Leidner & Castano, 2012) indicates that groups may automatically shift from individualising concerns about care and fairness to binding concerns when under threat. As such, it may be that everyone has moral intuitions beyond those of care and fairness, may differ in the relative strengths of these intuitions, and that certain contexts result in motivations to either suppress or enhance particular foundations. However, at present, this question suffers from an adequate way of more directly measuring intuitive-level foundation preferences.

This research presents the MFCT as a means to address these limitations, and begin to disentangle these conflicting proposals, by more directly tapping into intuitive preferences for foundations, and allowing for comparison with explicit foundations. We show that foundation preferences on the task remain under cognitive load, enhancing confidence that the task is measuring decisions between foundations that arise at the intuitive-level. In doing so, we find that explicit foundation endorsement is consistently and substantially ($.47 < r_{\tau} < .61$) reflected in intuitive preferences on the MFCT. Considering foundations individually, we consistently found medium to large correlations ($.30 < r\text{s} < .59$) between intuitive and explicit preferences for all five (with the exception of fairness in Studies 1 and 2). This suggests a reliable, but imperfect, match between foundation intuitions, as they manifest in choices on the MFCT, and explicit foundations. We further show that, in part, this mismatch explains unique structured relationships across both individualising and binding foundations.

9.1.4 Unique contribution in capturing moral foundations

MFT has produced a wealth of novel empirical findings (Graham et al., 2013), that span work that not only includes political ideology, but also social and political attitudes, cross-cultural differences, and a range of other constructs (see Chapter 8.1). Many of these findings apply the MFQ as the measure of foundation preference, and thus there is strong support for not only its internal validity – discussed above – but also for its external validity as a measure of moral foundation endorsement. However, also discussed above, the MFQ has been criticised and, as an explicit self-report measure, there are limits to the questions it is able to address. In particular it is not suitable for exploring how foundations dynamically interact with one another. However, 'real world' moral judgment often requires decisions between values (Jost, 2012), and thus the discussed tendency to measure foundations in isolation – as on the MFQ – misses out theoretically important information about how foundations operate in these kinds of judgments. A small handful of studies have put forward a 'moral trade-off hypothesis' to address this, predicting that as foundations conflict, whichever is more strongly endorsed will guide moral judgment and behaviour. These studies demonstrate that interactions between foundations – and individual differences in how these are traded off – is predictive in a number of contexts, including whistleblowing and prejudice towards sexual minorities (Dungan et al., 2014; Monroe & Plant, 2019; Waytz et al., 2013). Though even in this work, foundations are mostly measured in isolation, with relative values calculated as composites of these scores (see Chapter 2.3).

In contrast, in the MFCT, we capture relative preferences for foundations directly based on intuitive trade-offs between them. Taking three correlates that have both well-established, and controversial (see Chapter 8.1), associations with foundation endorsement of the MFQ, we replicate a model fit by Kugler et al. (2014) with foundation preferences captured on the MFCT. The MFCT not only replicates but also outperforms, explaining more variance overall than a model fit to MFQ foundation preferences (Study 5 – Chapter 8.2). Furthermore, partialling-out that which is uniquely explained by each measure, we show that the MFCT and MFQ explain similar amounts of variance. As such, we demonstrate the external validity of the MFCT, whilst also showing that what it measures is distinct from the MFQ. Thus, we demonstrate that the MFCT makes a unique contribution – separate from that of the MFQ – in capturing foundation preferences.

9.2 Limitations

We identify a number of important methodological and conceptual limitations to this research. Firstly, we did not carry out pretesting of the items included in the MFCT. In the task's development (Ahluwalia, 2015), items were adapted from the Moral Foundations Dictionary (MFD) (Graham et al., 2009). To create the MFD, Graham et al. (2009) identified words felt to best exemplify foundation virtues and vices from "thesauruses and conversations with colleagues" (p.1039), and it was constructed *a priori* as a list of isolated words and phrases that does not account for the granularity and context specificity of real-world usage. While the MFD has been applied in a number of settings (Brady, Wills, Jost, Tucker, & Van Bavel, 2017; Clifford & Jerit, 2013; Hoover, Mooijman, Lin, Ji, & Dehghani, 2018; Sagi & Dehghani, 2014; Weber et al., 2018; Wheeler, McGrath, & Haslam, 2019), it has also been criticised with regards to its scope, theoretical validity, and utility (Garten et al., 2018; Hopp, Fisher, Cornell, Huskey, & Weber, 2020; Sagi & Dehghani, 2014; Weber et al., 2018). Of particular relevance to the MFCT, as a trade-off task, is the critique that the MFD takes a 'winner-takes-all' approach in assigning words to discrete foundation categories (Hopp et al., 2020), compounded by a lack of the context and content specificity found in real-world moral language. In adapting from the MFD, we inherit these concerns: many items in the MFCT similarly lack specificity (e.g. 'Do something illegal', 'Act with integrity') and may thus be invoking multiple foundations. Though we find that the MFCT is stable and reliable, and explains more variance, relative to the MFQ, it remains to be seen whether these concerns are adding noise to this correlation. To confirm that MFCT items are targeting the purported foundations, we might have conducted a pre-study requiring participants to rate the relevance of items for each foundation. In addition, emerging work that seeks to develop more ecologically valid, data-driven versions (e.g. the extended Moral Foundations Dictionary: Hopp et al., 2020) may be used to highlight words most indicative of particular foundations, and thus better inform future development of the task.

A second methodological limitation relates to the design of studies in this research applying conditions that manipulate cognitive load/attention (Studies 2 to 4). We consider specific limitations, and ways of addressing these, in the discussion of each study in Chapters 6 and 7. In all of these studies, the main tests of difference between conditions yields a nonsignificant *p* value, and thus we are challenged with interpreting this non-significance. To aid this interpretation, we calculate Bayes factors for these comparisons, and hence show weak (Study 3) to moderate (Study 2 and 4) evidence for the null hypotheses that there is no difference between conditions in these studies. However, it is difficult to exclude the possibility that the null effects in these studies is attributable to an ineffectiveness of the manipulations. In Studies 2 and 3, we identified two alternative manipulations of cognitive attention that have been successfully shown to divide attention (tone counting task: Skitka et al., 2002; alcohol dosage to achieve .03 BAC: Dubowski, 1980), and argue for their effectiveness on this basis. However, the designs of these studies would have benefitted from manipulation checks, or a further condition that used a matched but non-moral task, to determine with certainty that our manipulations of attention were effective.

We now turn to a number of conceptual limitations. We propose that the MFCT captures intuitive conflict between foundations and operationalise this in quick judgments to determine which foundation-related virtue/vice is 'better'/'worse'. We have previously justified our choice to emphasise the speed of these decisions as a means of getting at moral intuitions. However, this conception of intuitive 'conflict' is different from that applied in literature that employs high-stake, sacrificial moral dilemmas (Crone & Laham, 2015; Cushman & Greene, 2012; Greene et al., 2008; Greene et al., 2004; Greene et al., 2001; Haidt, 2001; Moore et al., 2008; Moore et al., 2011; Piazza, Sousa, & Holbrook, 2013), in which participants are asked to choose an action that upholds one virtue or moral principle at the cost of another. Relative to this, choices on the MFCT may not be incurring much of a decision 'conflict'. This may explain weak trends in Ex-Gaussian analyses, in which we found consistent, but small, indicators of conflict (in τ) on the task – revisited below. One means of addressing this issue may be to modify instructions to emphasise higher stakes in the trade-off choices in the task, e.g. '*Imagine you can only perform one final good deed before you die. Which of the following would you choose?*' (for virtue actions). However, it may also be that the choices between foundations captured in the MFCT are made more through processes of evidence accumulation – discussed further in future directions – than via processes of conflict resolution.

Furthermore, it is at present beyond the scope of this body of research to address the key challenges put forward against MFT (see Chapter 2.2). We have instead argued that this debate is fuelled by ambiguities in measuring foundation intuitions.

These challenges centre around whether foundations are five multiple, distinct, and differentially activated 'moral' intuitions, or whether they might instead reduce to a single intuitive moral template (Schein & Gray, 2015, 2018), or be including non-moral, or even amoral, cognitive processes and motives (e.g. Kugler et al., 2014; Van Leeuwen & Park, 2009; Wright & Baril, 2011). In this research, we have remained relatively agnostic to both of these challenges. With regards to the former critique, the MFCT, as we have applied it here, does not test this hypothesis. Relevant to the latter critique, we replicate a model that is used by Kugler et al. (2014) to argue the binding foundations are manifestations of right-wing authoritarianism and social dominance orientation, both of which have established links to political conservatism, as well as a number of unsavoury social and political attitudes (e.g. Adorno et al., 1950; Altemeyer, 1996, 1998; Duckitt, 2001; Duckitt & Sibley, 2010; Jost et al., 2003; Pratto et al., 1994; Sidanius & Pratto, 1999; Sidanius et al., 1996). We primarily use this model as a nomological network of key variables relevant to moral foundations, for purposes of validating the MFCT. In contrast to Kugler et al. (2014), we do not interpret our replication as grounds for doubting the moral status of binding foundations, but rather as evidence that capturing intuitive-level foundation conflict has predictive value. In sum, we developed, and measured, foundations on the MFCT as five distinct kinds of competing intuitive concerns, and find that it is stable and reliable. However, this does not preclude that ultimately these concerns reduce to into harm, or are not in fact inherently moral-type concerns. Rather this research shows that capturing foundation preferences in this way makes a unique contribution to this literature.

The final, though related, limitation of this work is that it is not able to specify the cognitive mechanisms that underpin intuitive judgments between moral foundations. Instead, we have sought to show that these judgments are made at the intuitive level and that the MFCT, as a task, captures the result of these processes in choices made between foundations, and that these choices are related to how much value is placed on each foundation reported explicitly on the MFQ. Further to this, we have also sought to evidence that how much value, and the difference in value, of foundations in a choice, are reflected in the time to make these choices, and were also reflected in τ values, as a metric of demand for conflict resolution in decision-making. These analyses of response time data support our interpretation that the MFCT is tapping into cognitive conflict, however these effects were generally weak across all studies. However, alongside patterns of decreasing τ, we found inconsistent and varying patterns in μ across trials for individual participants – as the transduction component, we would not expect μ to differ on a trial-by-trial basis. Thus, other analytic methods will be required to provide further exposition into the cognitive processes underlying choices on the MFCT, and more specifically how the relative values placed on multiple moral foundations play a role in these processes. These are discussed as avenues for future research below.

9.3 Future Directions

There are several avenues for future research that we wish to highlight. First, the MFCT provides a dynamic tool that can be adapted and extended for a wide range of applications to explore moral judgments and their impacts on other psychological constructs, and behaviours. A number of studies have begun to explore the impacts of trade-offs on moral foundations across individuals (Dungan et al., 2014; Monroe & Plant, 2019; Waytz et al., 2013), finding that individual differences in tendencies to value one foundation over another are predictive in domains in which multiple foundations appear to be relevant, including in whistleblowing (loyalty vs. fairness - Waytz et al., 2013) and in attitudes toward sexual minorities (care vs. purity – Monroe & Plant, 2018). The MFCT provides a direct measure of these kinds of trade-offs that can be applied to probe these individual differences.

In addition, the MFCT could provide insights into moral inconsistency within individuals. In Chapter 8, we highlight ambiguities in findings showing that more conservative individuals have less consistency between their MFCT and MFQ responses, On the one hand this might be because conservatives endorse all five foundations as morally relevant, and thus their choices are less reliable. It may also be that, in measuring foundations in conflict, the MFCT captures unique aspects that becomes more apparent when individuals have more endorsed moral values. It may also be that conservatives are simply more morally inconsistent, and this is underpinned by cognitive processes that also result in the endorsement of all five foundations. At the same time, we find that more conservative individuals also appear to find it easier to make choices between foundations. This might be because in endorsing all five foundations, they find decisions between them less difficult, rather than more difficult. However, it may also be a result of other mechanisms that quickly resolve these kinds of moral judgments. Future research on the cognitive processes that operate in these judgments will be crucial in weighing these alternatives. One potential avenue may be connect to literature on metacognition and error-monitoring, which shows that people can effortlessly and accurately evaluate their decisions (Colombo, Iannello, & Antonietti, 2010; Yeung & Summerfield, 2012), by adapting the MFCT to ask participants to evaluate their certainty about each choice. We would expect high metacognitive certainty to correspond to stronger intuitions, and provide a more nuanced means of exploring consistency in these decisions. Furthermore, future research may also seek to establish the test-retest validity of the MFCT, and its association with ideological and cognitive style variables when it is administered to the same individuals multiple times.

In addition, future work may explore alternative methods of evaluating consistency both within the MFCT and between the MFCT and MFQ. In this research, we have used rank correlation coefficients as indicators of how relative foundation preferences measured on the MFCT corresponds to the MFQ. An alternative means may be to implement a Levenshtein distance style analysis (Levenshtein, 1966; Navarro, 2001) to quantify the match between these via 'edit distance', i.e. how many edits away they are from being coherent. In addition, variations of Levenshtein distance, e.g. the Needleman-Wunch measure, allow for more fine-grained score modelling (Doan, Halevy, & Ives, 2012) that could implement a set of weights to account more sensitively for the relative value placed on each foundation.

Finally, recent work has applied computational models to explore mechanisms in moral decisions (Baron & Gürçay, 2017; Kim et al., 2018; Pärnamets, Richardson, & Balkenius, 2014). To provide a sense of approaches in this literature: Kim et al. (2018) implement a computational model of binary moral dilemmas with a utility function that trades off outcomes based on weights of morally-relevant features of the dilemmas. Here, these value weights are inferred from a Bayesian model of group norms. Drift diffusion models (DDMs) (Ratcliff, 1978; Ratcliff & McKoon, 2008) have additionally been used to explore moral decisions as functions of relative value and visual fixation on binary moral choices (Pärnamets et al., 2014) and as features of dilemmas (Baron & Gürçay, 2017). DDMs model the cognitive processes in binary decisions, as an accumulation of evidence for a response, supposing a stochastic process of drift until this reaches a decision-threshold, and a responses is made (Baron & Gürçay, 2017; Ratcliff & McKoon, 2008). They account for behavioural data in these decisions, such as accuracy (which could be implemented as the expected response based on explicitly reported foundations) and response times, and could thus be applied to address hypotheses about the cognitive mechanisms that generate responses on the MFCT. The MFCT provides rich foundation choice data, making these avenues possible.

9.4 Conclusion

So what is worse: turning away vulnerable refugees, or taking support away from fellow citizens by overloading social services? In 2020, and amid the COVID-19 crisis, we are currently living through a time of particularly heated political, and moral, disagreement that makes it clear that people can have very different moral responses to seemingly similar content. How are judgments made about these moral conflicts? If these judgments are largely determined by distinct moral intuitions, these intuitions may compete with one another. We set out to capture this intuitive conflict. In doing so, we have developed the Moral Foundations Conflict Task, measuring moral values through fast trade-offs between them. We have sought to show that the MFCT measures foundation intuitions stably and reliably, and more deeply than the best established measure of foundation endorsement – the Moral Foundations Questionnaire – and in ways that are distinctly meaningful, and can thus contribute to understandings of morality that will help move theoretical development forward.

10 Bibliography

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11 Appendix 1: Chapter 3

Table 11.1. Items from the MFCT, split by foundation and formulation

Foundation	*Formulation*	*Item*
Care	Virtue Passive	Caring
		Compassionate
		Sympathetic
		Nurturing
	Virtue Active	Care for vulnerable people
		Show compassion when others suffer
		Defend vulnerable people
		Protect defenceless animals
	Vice Passive	Cruel
		Harmful
		Neglectful
		Aggressive
	Vice Active	Do something cruel
		Hurt others' feelings
		Harm defenceless animals
		Make other people suffer
Fairness	Virtue Passive	Fair
		Unbiased
		Tolerant
		Unprejudiced
	Virtue Active	Treat everyone fairly
		Treat everyone equally
		Be openminded about other people
		Protect others' rights
	Vice Passive	Unfair
		Unjust
		Biased
		Intolerant
	Vice Active	Treat some people differently
		Deny someone their rights*
		Discriminate against a group of people*
		Cheat to get ahead
Authority	Virtue Passive	Obedient
		Lawful
		Respectful
		Disciplined
	Virtue Active	Obey elders

		Comply with people in authority
		Respect the traditions of society
		Obey the law
	Vice Passive	Disobedient
		Rebellious
		Undisciplined
		Subversive
	Vice Active	Show a lack of respect for authority
		Cause chaos or disorder
		Do something illegal
		Act in an obstructive manner
Loyalty	Virtue Passive	Loyal
		Patriotic
		Devoted
		Dutiful
	Virtue Active	Show loyalty to friends
		Show love for your country
		Put family before yourself
		Act for the good of the group
	Vice Passive	Disloyal
		Unfaithful
		Unpatriotic
		Selfish
	Vice Active	Betray a friend
		Commit treason
		Insult your country
		Act for selfish reasons
Purity	Virtue Passive	Pure
		Pious
		Clean
		Virtuous
	Virtue Active	Act with integrity
		Act in ways that God would approve of*
		Maintain a clean reputation
		Act in a modest manner
	Vice Passive	Impure*
		Sinful
		Dirty
		Promiscuous
	Vice Active	Behave indecently
		Act in an obscene manner
		Do something disgusting*
		Act in an ungodly way

Note. * Omitted from final inter-foundation pairs.

Table 11.2. List of item pairs from the MFCT

Item 1	*Item 2*	*Foundation 1*	*Foundation 2*
Virtue Active			
Comply with people in authority	Protect defenceless animals	Authority	Care
Obey elders	Protect defenceless animals	Authority	Care
Protect defenceless animals	Respect the traditions of society	Care	Authority
Obey the law	Protect defenceless animals	Authority	Care
Comply with people in authority	Treat everyone equally	Authority	Fairness
Obey elders	Treat everyone equally	Authority	Fairness
Be openminded about other people	Comply with people in authority	Fairness	Authority
Be openminded about other people	Obey elders	Fairness	Authority
Comply with people in authority	Put family before yourself	Authority	Loyalty
Obey elders	Put family before yourself	Authority	Loyalty
Obey the law	Show love for your country	Authority	Loyalty
Put family before yourself	Respect the traditions of society	Loyalty	Authority
Act in a modest manner	Comply with people in authority	Purity	Authority
Act in a modest manner	Obey elders	Purity	Authority
Maintain a clean reputation	Obey the law	Purity	Authority
Act in a modest manner	Respect the traditions of society	Purity	Authority
Be openminded about other people	Care for vulnerable people	Fairness	Care
Care for vulnerable people	Protect others' rights	Care	Fairness
Defend vulnerable people	Treat everyone equally	Care	Fairness
Care for vulnerable people	Treat everyone fairly	Care	Fairness
Protect defenceless animals	Show loyalty to friends	Care	Loyalty
Act for the good of the group	Protect defenceless animals	Loyalty	Care
Show compassion when others suffer	Show loyalty to friends	Care	Loyalty
Act for the good of the group	Show compassion when others suffer	Loyalty	Care
Act with integrity	Care for vulnerable people	Purity	Care
Act with integrity	Defend vulnerable people	Purity	Care
Act with integrity	Show compassion when others suffer	Purity	Care
Act in a modest manner	Protect defenceless animals	Purity	Care
Show loyalty to friends	Treat everyone equally	Loyalty	Fairness
Be openminded about other people	Show loyalty to friends	Fairness	Loyalty

Protect others' rights	Show loyalty to friends	Fairness	Loyalty
Act for the good of the group	Treat everyone equally	Loyalty	Fairness
Act with integrity	Be openminded about other people	Purity	Fairness
Act with integrity	Protect others' rights	Purity	Fairness
Act with integrity	Treat everyone fairly	Purity	Fairness
Act with integrity	Treat everyone equally	Purity	Fairness
Act in a modest manner	Put family before yourself	Purity	Loyalty
Maintain a clean reputation	Show love for your country	Purity	Loyalty
Act for the good of the group	Act in a modest manner	Loyalty	Purity
Maintain a clean reputation	Put family before yourself	Purity	Loyalty
Virtue Passive			
Respectful	Nurturing	Authority	Care
Respectful	Sympathetic	Authority	Care
Lawful	Sympathetic	Authority	Care
Disciplined	Caring	Authority	Care
Respectful	Tolerant	Authority	Fairness
Lawful	Tolerant	Authority	Fairness
Respectful	Unprejudiced	Authority	Fairness
Disciplined	Fair	Authority	Fairness
Respectful	Loyal	Authority	Loyalty
Obedient	Patriotic	Authority	Loyalty
Respectful	Dutiful	Authority	Loyalty
Disciplined	Patriotic	Authority	Loyalty
Disciplined	Clean	Authority	Purity
Respectful	Virtuous	Authority	Purity
Lawful	Pure	Authority	Purity
Obedient	Pious	Authority	Purity
Caring	Tolerant	Care	Fairness
Sympathetic	Fair	Care	Fairness
Compassionate	Tolerant	Care	Fairness
Sympathetic	Unbiased	Care	Fairness
Sympathetic	Devoted	Care	Loyalty
Caring	Loyal	Care	Loyalty
Compassionate	Loyal	Care	Loyalty
Compassionate	Dutiful	Care	Loyalty
Compassionate	Virtuous	Care	Purity
Sympathetic	Clean	Care	Purity
Caring	Pure	Care	Purity
Compassionate	Pure	Care	Purity

Tolerant	Devoted	Fairness	Loyalty
Fair	Loyal	Fairness	Loyalty
Unbiased	Loyal	Fairness	Loyalty
Unbiased	Dutiful	Fairness	Loyalty
Unbiased	Virtuous	Fairness	Purity
Tolerant	Clean	Fairness	Purity
Fair	Pure	Fairness	Purity
Unbiased	Pure	Fairness	Purity
Patriotic	Pure	Loyalty	Purity
Loyal	Clean	Loyalty	Purity
Dutiful	Pious	Loyalty	Purity
Patriotic	Virtuous	Loyalty	Purity
Vice Active			
Do something cruel	Do something illegal	Care	Authority
Do something illegal	Harm defenceless animals	Authority	Care
Cause chaos or disorder	Do something cruel	Authority	Care
Cause chaos or disorder	Harm defenceless animals	Authority	Care
Do something illegal	Treat some people differently	Authority	Fairness
Cause chaos or disorder	Treat some people differently	Authority	Fairness
Act in an obstructive manner	Treat some people differently	Authority	Fairness
Cheat to get ahead	Do something illegal	Fairness	Authority
Act for selfish reasons	Cause chaos or disorder	Loyalty	Authority
Act for selfish reasons	Act in an obstructive manner	Loyalty	Authority
Commit treason	Do something illegal	Loyalty	Authority
Act for selfish reasons	Do something illegal	Loyalty	Authority
Act in an obstructive manner	Behave indecently	Authority	Purity
Act in an obscene manner	Do something illegal	Purity	Authority
Behave indecently	Show a lack of respect for authority	Purity	Authority
Behave indecently	Cause chaos or disorder	Purity	Authority
Cheat to get ahead	Make other people suffer	Fairness	Care
Cheat to get ahead	Hurt others' feelings	Fairness	Care
Do something cruel	Treat some people differently	Care	Fairness
Harm defenceless animals	Treat some people differently	Care	Fairness
Betray a friend	Do something cruel	Loyalty	Care
Betray a friend	Harm defenceless animals	Loyalty	Care
Commit treason	Do something cruel	Loyalty	Care
Commit treason	Harm defenceless animals	Loyalty	Care
Act in an obscene manner	Do something cruel	Purity	Care
Act in an obscene manner	Harm defenceless animals	Purity	Care

Act in an obscene manner	Hurt others' feelings	Purity	Care
Behave indecently	Do something cruel	Purity	Care
Commit treason	Treat some people differently	Loyalty	Fairness
Betray a friend	Treat some people differently	Loyalty	Fairness
Betray a friend	Cheat to get ahead	Loyalty	Fairness
Act for selfish reasons	Treat some people differently	Loyalty	Fairness
Act in an obscene manner	Treat some people differently	Purity	Fairness
Behave indecently	Treat some people differently	Purity	Fairness
Act in an obscene manner	Cheat to get ahead	Purity	Fairness
Behave indecently	Cheat to get ahead	Purity	Fairness
Act in an ungodly way	Insult your country	Purity	Loyalty
Act for selfish reasons	Behave indecently	Loyalty	Purity
Act in an obscene manner	Commit treason	Purity	Loyal
Act for selfish reasons	Act in an obscene manner	Loyalty	Purity
Vice Passive			
Undisciplined	Cruel	Authority	Care
Undisciplined	Neglectful	Authority	Care
Subversive	Cruel	Authority	Care
Disobedient	Harmful	Authority	Care
Undisciplined	Biased	Authority	Fairness
Undisciplined	Intolerant	Authority	Fairness
Subversive	Biased	Authority	Fairness
Rebellious	Unfair	Authority	Fairness
Undisciplined	Unpatriotic	Authority	Loyalty
Undisciplined	Unfaithful	Authority	Loyalty
Disobedient	Disloyal	Authority	Loyalty
Subversive	Unfaithful	Authority	Loyalty
Rebellious	Dirty	Authority	Purity
Disobedient	Promiscuous	Authority	Purity
Undisciplined	Sinful	Authority	Purity
Rebellious	Promiscuous	Authority	Purity
Cruel	Unfair	Care	Fairness
Aggressive	Biased	Care	Fairness
Harmful	Biased	Care	Fairness
Harmful	Intolerant	Care	Fairness
Cruel	Disloyal	Care	Loyalty
Neglectful	Disloyal	Care	Loyalty
Cruel	Selfish	Care	Loyalty
Aggressive	Unfaithful	Care	Loyalty
Cruel	Promiscuous	Care	Purity
Neglectful	Promiscuous	Care	Purity

Aggressive	Sinful	Care	Purity
Harmful	Sinful	Care	Purity
Biased	Disloyal	Fairness	Loyalty
Intolerant	Disloyal	Fairness	Loyalty
Biased	Selfish	Fairness	Loyalty
Unfair	Unfaithful	Fairness	Loyalty
Biased	Promiscuous	Fairness	Purity
Intolerant	Promiscuous	Fairness	Purity
Unfair	Sinful	Fairness	Purity
Unjust	Sinful	Fairness	Purity
Unfaithful	Promiscuous	Loyalty	Purity
Disloyal	Sinful	Loyalty	Purity
Selfish	Sinful	Loyalty	Purity
Unpatriotic	Promiscuous	Loyalty	Purity

12 Appendix 2: Chapter 6

12.1 Study 2

Valence score and length of items

As in Study 1, we fit a logistic model predicting whether or not an item was chosen based on valence score and length (Table 12.1). As in Study 1, items with higher valence scores and longer in length are more likely to be chosen.

Table 12.1. Choice by valence score and length for Study 2

	Model	
	β	OR
Fixed effects		
Intercept	.02 (.25)	1.02
Valence Score	1.37^{***} (.03)	3.94
Length	$.42^{***}$ (.03)	1.52
Valence Score : Length	$.37^{***}$ (.02)	1.44
Random effects - σ		
Condition	< .001	
Subject	< .001	
Item Pair	1.13	
Valence	.11	
Action	.31	
Marginal R^2 / Conditional R^2	.27 / .46	
LogLik	-20,349	
AIC	40,717	
BIC	40,792	

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 31,714. OR – Odds ratios. Fixed and random effects for logistic model predicting choice. Predictors have been standardised. For fixed effects, *SE* is provided in parentheses. Pseudo R^2 calculated using the delta method (Nakagawa et al., 2017).

Also as in Study 1, valence scores were higher for individualising foundations than for binding foundations, and this is reflected in separate models predicting valence score for choices (Table 12.2). For both chosen, $\beta = -1.86$, $p < .001$, and not chosen items, $\beta = -1.74$, $p < .001$, binding foundations had lower valence scores than individualising foundations, and were also shorter in length for both chosen, β = -.16, p < .001, and not chosen items, β = -.22, p < .001.

Table 12.2. Valence score and length of items by foundation for Study 2

	Models			
	Valence Score		Length	
	Chosen	Not Chosen	Chosen	Not Chosen
Fixed effects				
Intercept	-.20*** (.01)	.18*** (.01)	-.02* (.01)	.03*** (.01)
Foundation				
Binding v. Individualising	-1.86*** (.01)	-1.74*** (.02)	-.16*** (.02)	-.22*** (.02)
Fairness v. Care	.09*** (.01)	.05*** (.01)	.02† (.01)	-.14*** (.02)
Loyalty v. Authority	.37*** (.01)	.32*** (.01)	.04** (.02)	-.08*** (.01)
Purity v. Authority	-.18*** (.01)	-.01 (.01)	-.08*** (.02)	-.16*** (.01)
Random effects				
By Condition - σ				
Intercept	< .001	< .001	< .001	< .001
By Subject - σ				
Intercept	< .001	< .001	< .001	< .001
Item Pair	< .001	< .001	> .99	< .001
Valence	.62	.72	< .001	.98
Action	< .001	< .001	< .001	< .001
Residual	< .001	< .001	< .001	< .001
Marginal R^2/ Conditional R^2	.61 / .99	.48 / .99	.01 / .99	.03 / .99
LogLik	-14,459.00	-16,775.00	-21,900	-21,680
AIC	28,940	33,571	43,823	43,382
BIC	29,024	33,656	43,907	43,466

Note. † p < .10, * p < .05, ** p < .01, *** p < .001. Number of observations = 15,829. Fixed and random effects for separate models predicting valence score and length of chosen and not chosen items in a given trial. Outcome variables have been standardised. Individualising, care and authority are reference levels. For fixed effects, *SE* is provided in parentheses.

The difference in valence score for the items in a given trial also had an effect on RT, β = -.12, p < .001, with quicker choices as the difference in valence score between items in a trial increased (Table 12.3). There was also an effect for the difference in the length of items on RT, β = .08, p < .001, with slower choices between items with a larger difference in length.

Table 12.3. RT by difference in valence score and length for Study 2

	Models	
	log RT	
Fixed effects		
Intercept	-.0001 (.06)	-.0003 (.06)
Difference in Valence Score	-.12*** (.01)	
Difference in Length		.08*** (.01)
Random effects		
By Condition - σ		
Intercept	< .001	< .001
By Subject - σ		
Intercept	.55	.55
Item Pair	.48	.45
Valence	.15	.01
Action	.66	.69
Residual	< .001	< .001
Marginal R^2 / Conditional R^2	.01 / .99	.01 / .99
LogLik	-19,094	-19,180
AIC	38,203	38,376
BIC	38,265	38,438

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 15,829. Fixed and random effects for separate models predicting standardised log RT from standardised absolute differences in valence score and length between items in a given trial. For fixed effects, *SE* is provided in parentheses.

The effects of valence score and length found in Study 1 are replicated in Study 2. Items that are more positive (for foundation virtues) or negative (vices) are more likely to be chosen as better (virtues) or worse (vices), with slower choices when the two items in a trial are more closely matched on valence score. Items longer in length were also more likely to be chosen, with a greater difference in length between two items in a trial predicting longer RTs. Also as in Study 1, these effects are likely impacted by differences across foundations, with items for individualising foundations tending to be rated as are more positive/negative, and be slightly longer in length.

Weighted difference scores predicting RT

As in Study 1, a difference score was created for each inter-foundation combination to weight the difference between foundation scores by the mean score of the two foundations in a choice, such that higher scores would indicate higher value choices closer in value. Difference scores based on the MFQ and on the MFCT correlated at $r = .65$, $p <.001$, *95% CI* [.61, .68].

Separate multilevel models (see Figure 12.4) were fit to predict RT from difference scores based on MFQ and MFCT scores. There is a marginal effect for MFQ difference scores, $\beta = -.03$, $p < .10$, which contrary to expectation that an increased difference score would predict lower RT, shows a weak trend in the opposite direction. There is no effect for MFCT difference scores, $\beta = -.003$, $p > .10$.

There are no main effects of condition, βs < .04, ps > .10, and no evidence of an interaction between condition and MFQ difference scores, $\beta = -.03$, $p > .10$, however there is a marginal interaction for MFCT difference scores, $\beta = -.03$, $p < .10$, with a steeper downward trend in RT in the load condition (see Figure 12.1, panel b). However, these effects are small, which may indicate that the weighted difference score does not adequately capture differences in value.

Table 12.4. Predicting RT from condition and difference score based on MFQ and MFCT

	Models	
	log RT	
Fixed effects		
Intercept	-.02 (.08)	-.02 (.08)
Condition (Load v. Control)	.03 (.11)	.04 (.11)
Difference Score MFQ	-.03† (.02)	
Condition : Difference Score MFQ	-.03 (.02)	
Difference Score MFCT		-.003 (.01)
Condition : Difference Score MFCT		-.03† (.02)
Random effects		
By Subject - σ		
Intercept	.55	.55
Foundation Combination	< .001	< .001
Valence	< .001	< .001
Action	.34	.34
Residual	.76	.76
Marginal R^2 / Conditional R^2	.002 / .42	.001 / .42
LogLik	-19,464	-19,468
AIC	38,946	38,955
BIC	39,015	39,024

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 15,829. Fixed and random effects for separate models predicting log RT. Outcome variables have been standardised. Difference score calculated as *mean*($Score_1$, $Score_2$) * (1 - *abs*($Score_1$ - $Score_2$)). For condition: control is the reference level. For fixed effects, *SE* is provided in parentheses.

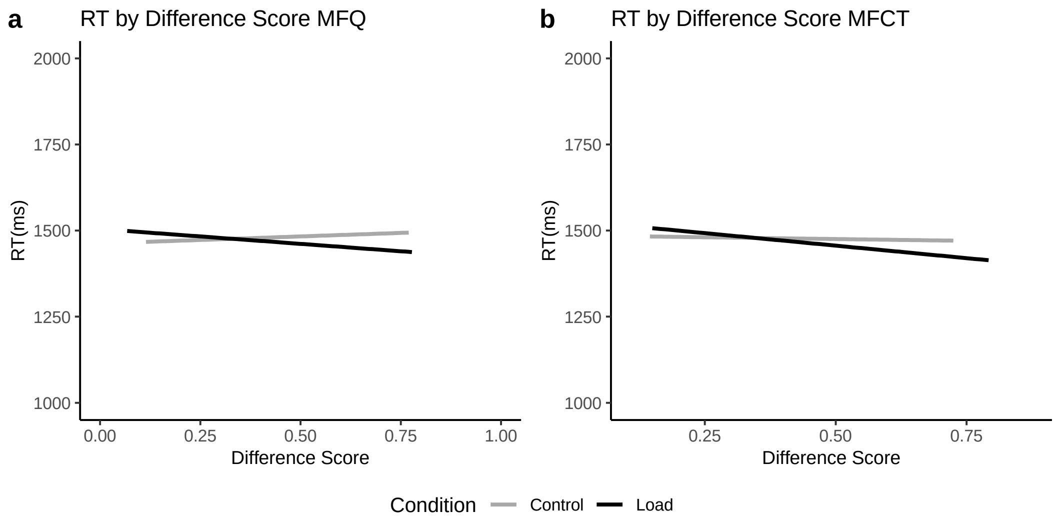

Figure 12.1. Condition and difference scores on MFQ (a) and the MFCT (b) predicting RT for Study 2. Scale on x-axis is derived from minimum and maximum differences scores, 0 – 1 for differences scores on the MFQ, and .11 – .88 for difference scores on the MFCT, where foundation scores are inter-dependent. Grey areas represent 95% CI boundaries.

As for Study 1, a further set of models were fit, collapsing RT and fitting within-subject Ex-Gaussian parameters to RT distributions for each inter-foundation combination (see Table 12.5). Here, difference scores based on neither MFQ nor MFCT scores, βs < |.03|, *p*s > .10, were significant for mean RT. However there were effects for μ, βs < -.09, *p*s < .01, and τ, βs > .06, *p*s < .10, with difference scores based on both the MFQ and MFCT, suggesting a potential dissociation between time to physically make decisions, and conflict in these decisions.

There are no main effects of condition, βs < |.23|, *p*s > .10, and no evidence of an interaction between condition and MFQ difference scores for mean RT, $\beta = -.06$, $p > .10$, however there are interactions between condition and MFQ difference scores for τ, $\beta = -.12$, $p < .05$, and MFCT difference scores for mean RT, $\beta = -.08$, $p < .05$, with steeper downward trends in the load condition (see Figure 12.2 and Figure 12.3).

Table 12.5. Predicting RT, μ and τ from condition and diff. score based on MFQ and MFCT for Study 2

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	-.004 (.13)	.08 (.10)	-.11 (.11)	-.01 (.13)	.08 (.10)	-.11 (.11)
Condition (Load v. Control)	.01 (.18)	-.17 (.14)	.23 (.15)	.01 (.18)	-.16 (.14)	.23 (.15)
Difference Score MFQ	-.03 (.03)	$-.16^{***}$ (.04)	$.07^{\dagger}$ (.04)			
Condition : Difference Score MFQ	-.06 (.04)	.10 (.06)	$-.12^{*}$ (.05)			
Difference Score MFCT				.01 (.02)	$-.09^{**}$ (.04)	$.06^{\dagger}$ (.03)
Condition : Difference Score MFCT				$-.08^{*}$ (.03)	.02 (.05)	-.07 (.05)
Random effects						
By Subject - σ						
Intercept	.88	.65	.73	.88	.65	.73
Foundation Combination	.42	.69	.62	.42	.69	.62
Residual	.21	.29	.27	.21	.29	.27
Marginal R^2 / Conditional R^2	.01 / .96	.02 / .92	.02 / .93	.002 / .96	.01 / .92	.02 / .93
Log Likelihood	-829	-1,219	-1,139	-831	-1,222	-1,140
Akaike Inf. Crit.	1,671	2,453	2,291	1,676	2,458	2,293
Bayesian Inf. Crit.	1,706	2,487	2,326	1,710	2,492	2,327

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 990. Fixed and random effects for separate models predicting log RT, μ and τ, estimated for each foundation combination. Outcome variables have been standardised. Difference score calculated as *mean*($Score_1$, $Score_2$) * (1 - *abs*($Score_1$ - $Score_2$)). For condition: control is the reference level. For fixed effects, *SE* is provided in parentheses.

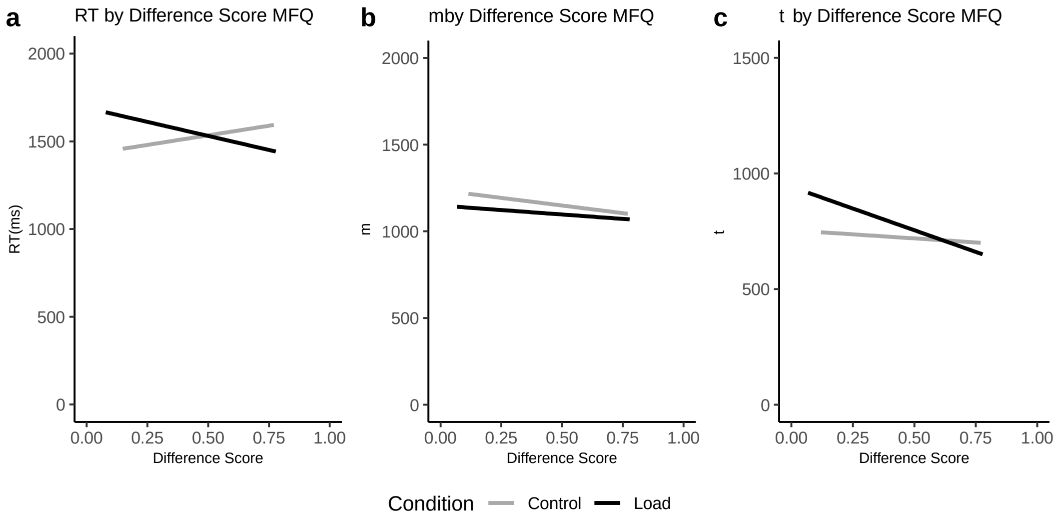

Figure 12.2. Condition and difference scores on MFQ predicting RT (a), μ (b) and τ (c) for Study 2. Scale on x-axis is derived from minimum and maximum differences scores, 0 – 1 for differences scores on the MFQ. Grey areas represent 95% CI boundaries.

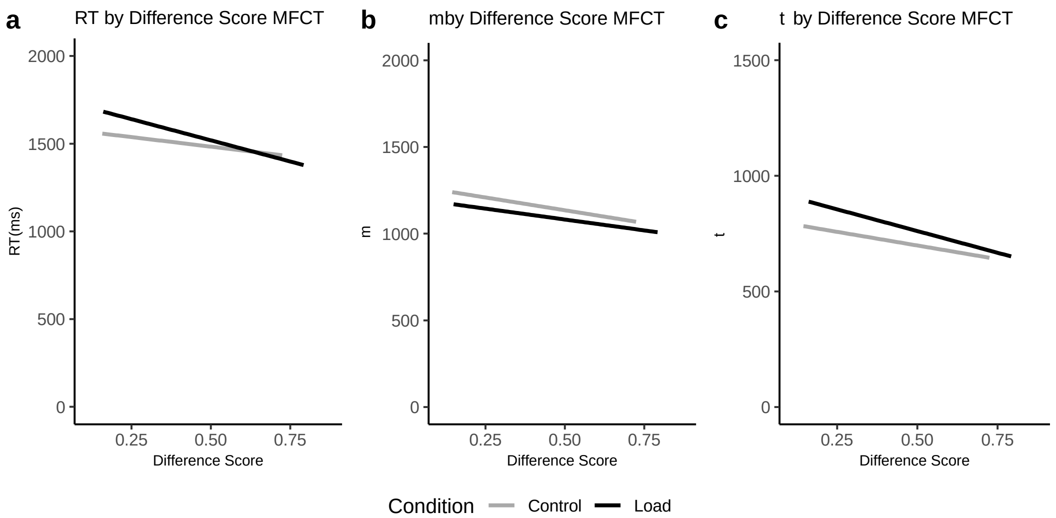

Figure 12.3. Condition and difference scores on MFCT predicting RT (a), μ (b) and τ (c) for Study 2. Scale on x-axis is derived from minimum and maximum differences scores, .11 – .88 for difference scores on the MFCT, where foundation scores are inter-dependent. Grey areas represent 95% CI boundaries.

Ranks apart split by rank chosen predicting RT

Multilevel models were fit to predict RT, μ and τ for each rank, based on the MFQ and the MFCT, that was chosen (1st rank to 5th rank) from the rank not chosen (also 1st rank to 5th rank) in a given trial. As in previous analyses, the small number of equally ranked choices were dropped, and a set of planned contrasts compare each rank category to the mean of the subsequent rank categories.

Ranks apart split by split by rank chosen on MFQ

Figure 12.4 shows plots for RT, μ and τ for each rank chosen, based on MFQ scores. For mean RT, μ and τ, there were no main effects of condition, βs < |.32|, *p*s > .10, with the exception of higher τ in the load condition for 4th, β = .28, p < .10 (see Table 12.9), and 5th rank choices, β = .49, p < .05 (see Table 12.10).

For mean RT, there were effects of ranks apart for 1st rank choices when the 2nd rank was not chosen, β = .15, p < .05 (see Table 12.6), and marginal effects for 2nd rank choices when the 3rd rank was not chosen, β = .17, p < .10 (see Table 12.7), and for 4th rank choices when the 2nd rank was not chosen, β = -.21, p < .10 (see Table 12.9). There were no other significant effects for ranks apart, βs < |.20|, *p*s > .10, nor interactions between condition and ranks apart, βs < |.24|, *p*s > .10 (see Table 12.6 – Table 12.10).

As in Study 1, there is a weak downward trend in μ. For 2nd rank choices, μ was higher against 4th ranked, compared to 5th ranked foundations, β < .35, p < .05 (see Table 12.7). Similarly, for 4th rank choices, μ was higher when the 3rd ranked was not chosen relative to 5th ranked foundations, β < .32, p < .10 (see Table 12.9). For τ, an opposite trend can be seen, with lower τ when the 1st ranked foundation was not chosen in 2nd rank, β = -.36, p < .01 (see Table 12.7), 3rd rank, β = -.34, p < .05 (see Table 12.8), and 4th rank choices, β = -.45, p < .05 (see Table 12.9), as well as when the 3rd versus the 5th rank, β = -.69, p < .001, and 4th rank is not chosen, β = -.36, p < .10, for 4th and 5th rank choices, respectively (see Table 12.9 and Table 12.10). There were no other significant effects for ranks apart for μ, βs < |.26|, *p*s > .10, nor τ, βs < |.33|, *p*s > .10.

There were a number of significant interactions between ranks apart and condition. In μ, when 3rd ranked foundations were chosen, there is a larger difference, with higher μ in the control condition, when the 5th rank was not chosen versus compared to when the 4th rank was not chosen, β < .46, p < .10 (see Table 12.8). An interaction can also be seen for 5th rank choices, with a larger difference, and higher μ in the control condition, when the 2nd rank was not chosen relative to lower ranks, β < .48, p < .10 (see Table 12.10). In τ, there is a marginally larger difference, with higher τ in the load condition, when 3rd ranked foundations were not chosen, compared to lower ranks, in both 1st rank, β = .29, p < .10, and 4th rank choices, β = .47, p < .10 (see Table

12.6 and Table 12.9). No other interactions were significant for μ, βs < |.29|, ps > .10, nor τ, βs > |.50|, ps > .10.

As in Study 1, these models suggest a weak pattern with μ decreasing, and τ increasing, for choices between lower ranked foundations. There were no consistent differences in mean RT, μ and τ, across conditions.

Ranks apart split by split by rank chosen on MFCT

Figure 12.5 shows plots for RT, μ and τ for each rank chosen, based on MFCT scores. For mean RT, there were no significant main effects of condition, βs < .11, ps > .10. There were marginal effects for μ and τ, with lower μ, β = -.26, p < .10, for 1st rank choices (see Table 12.6), and higher τ in the load condition for 1st rank, β = .30, p < .10 (see Table 12.6), 2nd rank, β = .30, p < .10 (see Table 12.7), and 4th rank choices, β = .27, p < .10 (see Table 12.9).

There were some main effects of ranks apart on mean RT, with significantly higher RT for 1st rank choices against 2nd ranked compared to lower ranked foundations, β = .21, p < .01 (see Table 12.6), and lower RT for 4th rank choices against 1st ranked compared to lower ranked foundations, β = -.24, p < .05 (see Table 12.9). Furthermore, there were significant interactions for 1st and 4th rank choices, with a larger difference in RT between conditions, with longer RT in the control condition, against 2nd ranked foundations in the former, β = -.26, p < .01 (see Table 12.6), and with a larger difference, and longer RT in the load condition, against 1st ranked foundations in the latter, β = .26, p < .10 (see Table 12.9). There were no other significant effects for ranks apart, βs < |.18|, ps > .10, nor interactions, βs < |.17|, ps > .10 (see Table 12.6 – Table 12.10).

For 1st rank choices, μ was higher, β = -.25, p < .05, and τ marginally lower, β = .22, p < .10, against 3rd ranked foundations. τ was also lower against 2nd ranked foundations, β = .22, p < .10 (see Table 12.6). For 2nd ranked choices, τ was lower against 1st ranked, β = .22, p < .10, and 3rd ranked, β = .22, p < .10, compared to lower ranked foundations (see Table 12.7). Similarly for 3rd ranked choices, τ was lower against 2nd ranked, β = -.35, p < .01, and μ was higher, β = -.33, p < .05, and τ lower, β = .37, p < .05, against 4th versus 5th ranked foundations (see Table 12.8). For 4th rank choices against 2nd ranked foundations, μ was marginally higher, β = -.25, p < .10, and τ was lower, β =

.52, $p < .001$, relative to lower ranked foundations (see Table 12.9). There were no other main effects for μ, βs < |.25|, ps > .10, nor τ, βs < |.25|, ps > .10.

As for ranks apart based on the MFQ, there were a number of significant interactions between ranks apart and condition. In μ, for 1st rank choices , there was a marginally smaller difference for 3rd ranked relative to lower ranked foundations, β = .31, $p < .10$, with a higher μ in the control condition for lower ranks. This was also the case in 4th rank choices, where the 1st ranked foundation was not chosen, β = .41, p < .10. In τ, there were interactions for 3rd rank choices, with a smaller difference between conditions in choices against 1st ranked foundations compared with lower ranks, β = -.35, $p < .10$, and a larger difference for 4th versus 5th ranked foundations, β = .50, $p < .05$, with higher τ in the load condition. No other interactions were significant for μ, βs < |.38|, ps > .10, nor τ, βs > |.28|, ps > .10.

Similar to previous, these models suggest weakly decreasing μ, and increasing τ, for choices between lower ranked foundations, patterns which are not reflected in mean RT. As for ranks based on the MFQ, there were no consistent differences in mean RT, μ and τ, across conditions.

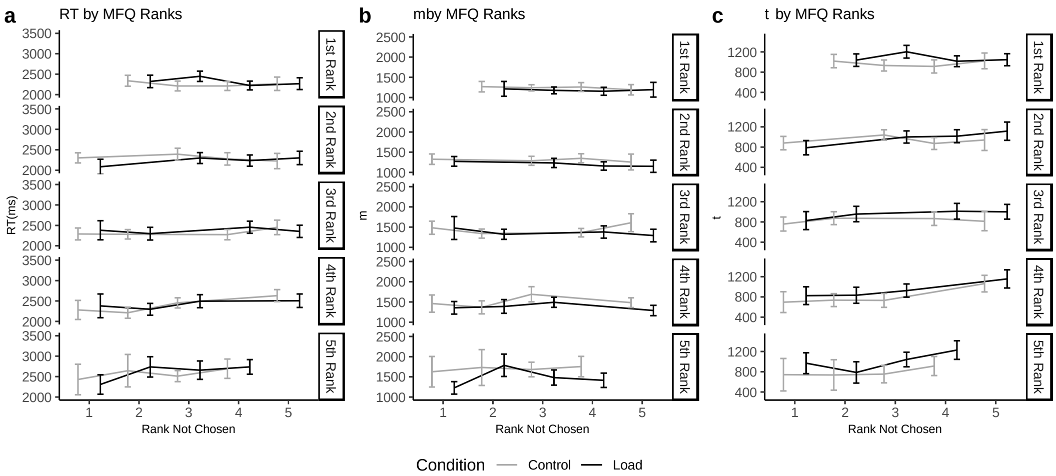

Figure 12.4. Condition and ranks chosen on MFQ, split by ranks not chosen, predicting RT (a), μ (b) and τ (c) for Study 2. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

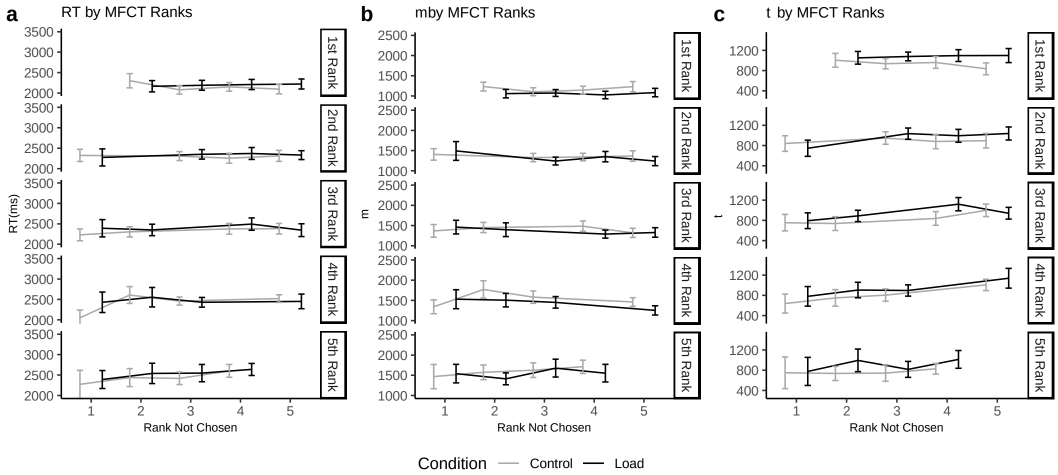

Figure 12.5. Condition and ranks chosen on MFCT, split by ranks not chosen, predicting RT (a), μ (b) and τ (c) for Study 2. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

Table 12.6. Predicting RT, μ and τ for 1st Rank choices on the MFQ and MFCT for Study 2

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	-.09 (.13)	.05 (.12)	-.10 (.12)	-.08 (.13)	.13 (.11)	-.16 (.11)
Condition (Load v. Control)	.12 (.19)	-.13 (.17)	.18 (.17)	.13 (.19)	-.26† (.16)	.30† (.16)
Ranks Apart						
2 RNC v. 3, 4, 5	.15* (.07)	.08 (.12)	.09 (.11)	.21** (.07)	.19 (.12)	.22† (.11)
3 RNC v. 4, 5	.05 (.08)	.15 (.13)	-.06 (.12)	-.01 (.07)	-.25* (.13)	.22† (.12)
4 RNC v. 5	.03 (.10)	.23 (.17)	-.16 (.16)	.10 (.09)	-.15 (.15)	.09 (.14)
Condition : Ranks Apart						
Condition : 2 RNC v. 3, 4, 5	-.15 (.10)	-.06 (.16)	-.17 (.16)	-.26** (.10)	-.20 (.17)	-.23 (.16)
Condition : 3 RNC v. 4, 5	.15 (.11)	-.05 (.18)	.29† (.17)	.02 (.11)	.31† (.18)	-.16 (.17)
Condition : 4 RNC v. 5	.07 (.14)	-.20 (.23)	.22 (.22)	-.11 (.13)	-.03 (.21)	.06 (.20)
Random effects						
By Subject - σ						
Intercept	.90	.74	.76	.91	.68	.72
Residual	.41	.66	.64	.42	.71	.67
Marginal R^2 / Conditional R^2	.01 / .83	.01 / .56	.02 / .59	.01 / .83	.03 / .50	.03 / .55
LogLik	-328	-432	-426	-354	-486	-473
AIC	677	883	872	729	991	965

BIC	715	922	910	768	1,031	1,005

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 348 (MFQ) and 382 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. For condition: control is the reference level. Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

Table 12.7. Predicting RT, μ and τ for 2nd Rank choices on the MFQ and MFCT for Study 2

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	-.01 (.13)	.08 (.12)	-.04 (.11)	-.04 (.13)	.04 (.11)	-.16 (.11)
Condition (Load v. Control)	.02 (.19)	-.20 (.17)	.11 (.16)	.08 (.19)	-.10 (.16)	.30† (.16)
Ranks Apart						
1 RNC v. 3, 4, 5	.01 (.09)	.11 (.12)	-.36** (.13)	.04 (.08)	.14 (.12)	.22† (.11)
3 RNC v. 4, 5	.17† (.09)	-.002 (.13)	.12 (.14)	.03 (.09)	-.004 (.13)	.22† (.12)
4 RNC v. 5	.13 (.12)	.35* (.17)	-.19 (.19)	.01 (.10)	-.01 (.15)	.09 (.14)
Condition : Ranks Apart						
Condition : 1 RNC v. 3, 4, 5	-.18 (.12)	.22 (.17)	-.08 (.19)	-.17 (.12)	.18 (.18)	-.23 (.16)
Condition : 3 RNC v. 4, 5	-.12 (.13)	.24 (.18)	-.26 (.20)	-.02 (.12)	-.02 (.18)	-.16 (.17)
Condition : 4 RNC v. 5	-.09 (.17)	-.23 (.23)	.18 (.25)	-.04 (.14)	.20 (.22)	.06 (.20)
Random effects						
By Subject - σ						
Intercept	.88	.72	.64	.88	.69	.60
Residual	.48	.68	.74	.48	.72	.78
Marginal R^2 / Conditional R^2	.01 / .77	.03 / .55	.04 / .45	.003 / .77	.02 / .49	.03 / .39
LogLik	-358	-429	-443	-386	-481	-473
AIC	736	879	905	791	983	965
BIC	774	917	944	830	1,022	1,005

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 340 (MFQ) and 375 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. For condition: control is the reference level. Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

Table 12.8. Predicting RT, μ and τ for 3rd Rank choices on the MFQ and MFCT for Study 2

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	-.02 (.13)	.09 (.11)	-.07 (.11)	-.05 (.13)	.04 (.11)	-.09 (.11)
Condition (Load v. Control)	.06 (.18)	-.17 (.15)	.16 (.15)	.11 (.18)	-.05 (.16)	.15 (.15)
Ranks Apart						
1 RNC v. 2, 4, 5	-.07 (.10)	.12 (.15)	-.34* (.16)	-.07 (.09)	-.01 (.15)	-.13 (.15)
2 RNC v. 4, 5	-.08 (.10)	-.17 (.16)	-.12 (.16)	-.07 (.09)	.10 (.14)	-.35** (.14)
4 RNC v. 5	-.05 (.13)	-.24 (.20)	.02 (.20)	-.02 (.10)	.33* (.16)	-.37* (.16)
Condition : Ranks Apart						
Condition : 1 RNC v. 2, 4, 5	.07 (.14)	-.02 (.22)	-.03 (.22)	.10 (.14)	.29 (.21)	-.35† (.21)
Condition : 2 RNC v. 4, 5	-.03 (.14)	.13 (.22)	-.004 (.23)	.04 (.12)	.04 (.19)	.04 (.19)
Condition : 4 RNC v. 5	.24 (.17)	.46† (.27)	-.05 (.27)	.14 (.15)	-.38 (.23)	.50* (.23)
Random effects						
By Subject - σ						
Intercept	.85	.60	.58	.87	.65	.61
Residual	.50	.79	.80	.48	.76	.75
Marginal R^2 / Conditional R^2	.01 / .75	.02 / .37	.03 / .36	.01 / .76	.02 / .43	.06 / .43
LogLik	-342	-422	-424	-367	-464	-456
AIC	704	864	868	754	947	933
BIC	742	902	906	793	986	972

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 315 (MFQ) and 351 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. For condition: control is the reference level. Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

Table 12.9. Predicting RT, μ and τ for 4th Rank choices on the MFQ and MFCT for Study 2

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	-.01 (.14)	.07 (.13)	-.15 (.11)	-.04 (.13)	.08 (.11)	-.15 (.10)
Condition (Load v. Control)	.03 (.19)	-.14 (.17)	.28† (.16)	.10 (.19)	-.16 (.15)	.27† (.14)

	log RT	log μ	log τ	log RT	log μ	log τ
Ranks Apart						
1 RNC v. 2, 3, 5	-.04 (.12)	.07 (.17)	-.45* (.18)	-.24* (.11)	-.25 (.18)	-.12 (.19)
2 RNC v. 3, 5	-.21† (.11)	-.26 (.16)	-.19 (.18)	.04 (.09)	.25† (.14)	-.52*** (.15)
3 RNC v. 5	-.09 (.13)	.32† (.18)	-.69*** (.20)	.01 (.10)	.12 (.16)	-.21 (.17)
Condition : Ranks Apart						
Condition : 1 RNC v. 2, 3, 5	-.10 (.16)	-.11 (.22)	.06 (.24)	.26† (.15)	.41† (.24)	-.16 (.26)
Condition : 2 RNC v. 3, 5	.06 (.15)	.29 (.22)	-.08 (.24)	.03 (.13)	-.002 (.21)	.25 (.22)
Condition : 3 RNC v. 5	.13 (.17)	.05 (.24)	.47† (.27)	-.02 (.15)	.21 (.23)	.002 (.25)
Random effects						
By Subject - σ						
Intercept	.85	.70	.57	.87	.61	.51
Residual	.49	.70	.77	.48	.76	.82
Marginal R^2 / Conditional R^2	.01 / .76	.03 / .51	.09 / .41	.01 / .77	.04 / .41	.06 / .32
LogLik	-299	-359	-366	-338	-423	-431
AIC	617	737	752	697	867	883
BIC	653	773	788	735	904	920

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 278 (MFQ) and 321 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. For condition: control is the reference level. Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

Table 12.10. Predicting RT, μ and τ for 5th Rank choices on the MFQ and MFCT for Study 2

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	-.01 (.18)	.22 (.15)	-.28* (.14)	.01 (.14)	.12 (.13)	-.09 (.11)
Condition (Load v. Control)	.13 (.24)	-.32 (.20)	.49* (.19)	.08 (.20)	-.18 (.18)	.16 (.16)
Ranks Apart						
1 RNC v. 2, 3, 4	-.20 (.14)	-.14 (.21)	-.33 (.22)	.06 (.17)	.04 (.23)	.01 (.26)
2 RNC v. 3, 4	.10 (.15)	.05 (.21)	-.08 (.23)	-.01 (.11)	-.08 (.16)	-.17 (.18)
3 RNC v. 4	-.15 (.13)	-.05 (.20)	-.36† (.22)	-.18 (.12)	-.16 (.16)	-.25 (.19)
Condition : Ranks Apart						
Condition : 1 RNC v. 2, 3, 4	.01 (.20)	-.24 (.29)	.50 (.31)	-.15 (.21)	-.05 (.30)	-.28 (.34)

Condition : 2 RNC v. 3, 4	.05 (.19)	.48† (.28)	-.36 (.30)	.03 (.16)	-.09 (.23)	.26 (.27)
Condition : 3 RNC v. 4	.03 (.18)	.16 (.27)	.20 (.29)	.09 (.17)	.35 (.23)	.08 (.27)
Random effects						
By Subject - σ						
Intercept	.86	.66	.55	.83	.65	.45
Residual	.48	.71	.78	.53	.75	.88
Marginal R^2 / Conditional R^2	.02 / .76	.06 / .49	.09 / .40	.01 / .72	.02 / .44	.02 / .23
LogLik	-209	-251	-258	-300	-352	-369
AIC	438	522	536	621	725	757
BIC	471	555	569	657	761	793

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 196 (MFQ) and 267 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. For condition: control is the reference level. Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

12.2 Study 3

Gender differences in alcohol consumption

Due to low expected frequencies, a Fisher's Exact test were used to explore gender effects. We found that how often participants consumed alcohol, $p > .10$, and how much consumed per week, $p > .10$, did not differ by gender.

Valence score and length of items

As in Study 1 and 2, we fit a logistic model predicting whether an item was chosen based on valence score and length (Table 12.11). As in Study 1 and 2, items with higher valence scores and longer in length are more likely to be chosen.

Table 12.11. Choice by valence score and length for Study 3

	Model	
	β	OR
Fixed effects		
Intercept	.02 (.22)	1.02
Valence Score	1.37*** (.03)	3.93
Length	.38*** (.04)	1.46
Valence Score : Length	.34*** (.02)	1.40
Random effects - σ		
Condition	< .001	
Subject	< .001	
Item Pair	1.12	
Valence	.10	
Action	.27	
Marginal R^2 / Conditional R^2	.27 / .45	
LogLik	-18,267	
AIC	36,553	
BIC	36,627	

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 28,448. OR – Odds ratios. Fixed and random effects for logistic model predicting choice. Predictors have been standardised. For fixed effects, *SE* is provided in parentheses. Pseudo R^2 calculated using the delta method (Nakagawa et al., 2017).

Also as in Study 1 and 2, valence scores were higher for individualising foundations than for binding foundations, and this is reflected in separate models predicting valence score for choices (Table 12.12). For both chosen, β = -1.84, p < .001, and not chosen items, β = -1.77, p < .001, binding foundations had lower valence scores than individualising foundations, and were shorter in length for both chosen, β = -.15, p < .001, and not chosen items, β = -.21, p < .001.

Table 12.12. Valence score and length of items by foundation for Study 3

	Models			
	Valence Score		Length	
	Chosen	Not Chosen	Chosen	Not Chosen
Fixed effects				
Intercept	-.20*** (.01)	.18*** (.01)	-.02* (.01)	.03** (.01)
Foundation				
Binding v. Individualising	-1.84*** (.01)	-1.77*** (.02)	-.15*** (.02)	-.21*** (.02)
Fairness v. Care	.09*** (.01)	.04*** (.01)	.01 (.01)	-.11*** (.02)
Loyalty v. Authority	.32*** (.01)	.35*** (.01)	.06*** (.02)	-.10*** (.01)
Purity v. Authority	-.15*** (.01)	-.03** (.01)	-.08*** (.02)	-.16*** (.01)
Random effects				
By Condition - σ				
Intercept	< .001	< .001	< .001	< .001
By Subject - σ				
Intercept	< .001	< .001	< .001	< .001
Item Pair	.24	.52	.55	.60
Valence	.28	.35	.60	.52
Action	.52	.34	.57	.58
Residual	.01	.01	.02	.03
Marginal R^2/ Conditional R^2	.59 / >.99	.50 / >.99	.005 / >.99	.03 / >.99
LogLik	-13,798	-15,320	-20,144	-19,939
AIC	27,617	30,661	40,310	39,901
BIC	27,700	30,744	40,393	39,984

Note. † p < .10, * p < .05, ** p < .01, *** p < .001. Number of observations = 14,224. Fixed and random effects for separate models predicting valence score and length of chosen and not chosen items in a given trial. Outcome variables have been standardised. Individualising, care and authority are reference levels. For fixed effects, *SE* is provided in parentheses.

Also as in Study 1 and 2, the difference in valence score for the items in a given trial also had an effect on RT, β = -.06, $p < .001$, with quicker choices as the difference in valence score between items in a trial increased (Table 12.13). There was also an effect for the difference in the length of items on RT, β = -.02, $p < .05$, however this was in an opposite direction to previous studies with faster choices between items with a larger difference in length.

Table 12.13. RT by difference in valence score and length for Study 3

	Models	
	log RT	
Fixed effects		
Intercept	-.001 (.07)	-.001 (.07)
Difference in Valence Score	$-.06^{***}$ (.01)	
Difference in Length		$-.02^{*}$ (.01)
Random effects		
By Condition - σ		
Intercept	.05	.05
By Subject - σ		
Intercept	.47	.47
Valence	< .001	< .001
Action	.33	.35
Residual	.81	.81
Marginal R^2 / Conditional R^2	.003 / .34	< .001 / .35
LogLik	-17,619	-17,643
AIC	35,253	35,300
BIC	35,306	35,352

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 14,224. Fixed and random effects for separate models predicting standardised log RT from standardised absolute differences in valence score and length between items in a given trial. For fixed effects, *SE* is provided in parentheses. Models that included item pair as a random effect failed to converge and this term was therefore dropped from analysis.

Effects of valence score and length found in Study 1 and 2 are largely replicated in Study 3. More positive (for foundation virtues) or negative (vices) items are more likely to be chosen, with slower choices when the two items are more closely matched on valence score. Longer items are also more likely to be chosen, but contrary to Study

1 and 2, a greater difference in length between two items predicted shorter RTs in Study 3. Also as in the preceding studies, this is likely impacted by differences across foundations, with items for individualising foundations tending to be rated as are more positive/negative, and be longer in length.

Weighted difference scores predicting RT

As in Study 1 and 2, a difference score was created for each inter-foundation combination to weight by the mean score of foundations in a choice. Difference scores based on the MFQ and on the MFCT correlated at r = .71, p < .001, *95% CI* [.68, .75].

Separate multilevel models (see Table 12.14) were fit to predict RT from difference scores based on MFQ and MFCT scores. There were no effects for MFQ or MFCT difference scores, βs = .19, ps < .10. Consistent with previous analyses, there were marginal main effects of condition, βs = .04, ps > .10, but no evidence of an interaction between condition and MFQ or MFCT difference scores, βs = .01, ps > .10. As in Study 1 an 2, these results may indicate that the weighted difference score does not adequately capture differences in value.

Table 12.14. Predicting RT from condition and difference score based on MFQ and MFCT for Study 3

	Models	
	log RT	
Fixed effects		
Intercept	-.10 (.08)	-.10 (.08)
Condition (Alcohol v. Control)	.19† (.11)	.19† (.11)
Difference Score MFQ	-.02 (.02)	
Condition : Difference Score MFQ	.01 (.02)	
Difference Score MFCT		-.02 (.01)
Condition : Difference Score MFCT		.01 (.02)
Random effects		
By Subject - σ		
Intercept	.49	.49
Foundation Combination	< .001	< .001
Valence	< .001	< .001
Action	.35	.35
Residual	.79	.79
Marginal R^2 / Conditional R^2	.01 / .38	.01 / .38

LogLik	-18,025	-18,025
AIC	36,069	36,068
BIC	36,137	36,136

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 14,224. Fixed and random effects for separate models predicting log RT. Outcome variables have been standardised. Difference score calculated as *mean*($Score_1$, $Score_2$) * (1 - *abs*($Score_1$ - $Score_2$)). For condition: control is the reference level. For fixed effects, *SE* is provided in parentheses.

A further set of models were fit, collapsing RT and fitting within-subject Ex-Gaussian parameters for each inter-foundation combination (see Table 12.15). Here, there were no significant effects for difference scores based on either MFQ or MFCT scores, βs < |.07|, *p*s > .10. Again, there were marginal main effects of condition for mean RT, βs = .33, *p*s < .10, and τ, $\beta = .30$, $p < .10$, but no evidence of interactions between condition and MFQ or MFCT difference scores, βs < |.08|, *p*s > .10.

Table 12.15. Predicting RT, μ and τ from condition and diff. score based on MFQ and MFCT for Study 3

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	-.17 (.13)	-.06 (.11)	-.15 (.11)	-.17 (.13)	-.06 (.11)	-.15 (.11)
Condition (Alcohol v. Control)	.33† (.18)	.11 (.15)	.30† (.15)	.33† (.18)	.10 (.15)	.30† (.15)
Difference Score MFQ	-.03 (.03)	.03 (.05)	-.07 (.05)			
Condition : Difference Score MFQ	.01 (.05)	-.07 (.07)	.08 (.06)			
Difference Score MFCT				-.02 (.03)	-.01 (.04)	-.02 (.04)
Condition : Difference Score MFCT				.02 (.04)	-.05 (.05)	.03 (.05)
Random effects						
By Subject - σ						
Intercept	.84	.65	.68	.84	.65	.68
Foundation Combination	.45	.70	.66	.45	.69	.66
Residual	.22	.29	.28	.22	.29	.28
Marginal R^2 / Conditional R^2	.03 / .95	.004 / .91	.03 / .92	.03 / .95	.01 / .91	.02 / .92
Log Likelihood	-796	-1,096	-1,059	-797	-1,095	-1,060
Akaike Inf. Crit.	1,607	2,205	2,132	1,607	2,204	2,134
Bayesian Inf. Crit.	1,640	2,238	2,165	1,641	2,237	2,168

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 881. Fixed and random effects for separate models predicting log RT, μ and τ, estimated for each foundation combination. Outcome variables have been standardised. Difference score calculated as *mean*($Score_1$, $Score_2$) * (1 - *abs*($Score_1$ - $Score_2$)). For condition: control is the reference level. For fixed effects, *SE* is provided in parentheses.

Ranks apart split by rank chosen predicting RT

Multilevel models were fit to predict RT, μ and τ for each rank, based on the MFQ and the MFCT, that was chosen from the rank not chosen in a given trial. As in previous analyses, equally ranked choices were dropped, and a set of planned contrasts compare each rank category to the mean of the subsequent rank categories.

Ranks apart split by split by rank chosen on MFQ

Figure 12.6 shows plots for RT, μ and τ for each rank chosen, based on MFQ scores. There were marginal main effects of condition for mean RT on 1st rank choices, $\beta = .34$, $p < .10$ (see Table 12.16), and 3rd rank choices, $\beta = .32$, $p < .10$ (see Table 12.18), and a significant effect for τ on 1st rank choices, $\beta = .33$, $p < .05$, with higher values in the alcohol condition. There were no other main effects of condition for mean RT, μ and τ, βs < |.37|, *p*s > .10 (see Table 12.16 – Table 12.20).

For mean RT, there were only effects of ranks apart for 1st rank choices when the 2nd rank was not chosen, $\beta = .21$, $p < .05$, and a marginal effect when the 4th rank was not chosen, $\beta = .23$, $p < .10$ (see Table 12.16). There were no other significant effects for ranks apart, βs < |.17|, *p*s > .10, nor interactions between condition and ranks apart, βs < |.23|, *p*s > .10 (see Table 12.16 – Table 12.20).

As in Study 1 and 2, there is a weak downward trend in μ (see Figure 12.6, panel b), however only a few planned contrasts are significant. For 3rd rank choices, μ was higher against 1st ranked, $\beta = .24$, $p < .10$ (see Table 12.18). For τ, an opposite trend can be seen (see Figure 12.6, panel c), with lower τ against 1st ranked, $\beta = -.40$, $p < .01$, and 2nd ranked foundations, $\beta = -.54$, $p < .01$ (see Table 12.18), and for 4th rank choices against 2nd ranked foundations, $\beta = -.64$, $p < .001$ (see Table 12.19). There were no other significant effects for ranks apart for μ, βs < |.22|, *p*s > .10, nor τ, βs < |.39|, *p*s > .10.

There were a number of significant interactions between ranks apart and condition. In μ, when 1st ranked foundations were chosen, there is a larger difference, with higher μ in the alcohol condition, when the 3rd rank was not chosen versus lower ranks, $\beta = .32$, $p < .10$ (see Table 12.16). An interaction can also be seen for 5th rank choices, with a larger difference, and higher μ in the alcohol condition, when the 1st rank was not chosen relative to lower ranks, $\beta = .65$, $p < .05$ (see Table 12.20). In τ, there are marginally larger differences, with higher τ in the alcohol condition, when 1st ranked, $\beta = .37$, $p < .10$, and 2nd ranked foundations, $\beta = .39$, $p < .10$, were not chosen in 3rd rank choices. In 5th rank choices, there was a larger difference against 1st ranked choices, $\beta = -.89$, $p < .05$, in the opposite direction with higher τ in the control condition. No other interactions were significant for μ, βs < |.36|, ps > .10, nor τ, βs > |.39|, ps > .10.

As in Study 1 and 2, these models suggest a weak pattern with μ decreasing, and τ increasing for choices between lower ranked foundations, though fewer significant planned contrasts are seen here. As in Study 2, there are no consistent differences in mean RT, μ and τ, across conditions.

Ranks apart split by split by rank chosen on MFCT

Figure 12.7 shows plots for RT, μ and τ for each rank chosen, based on MFCT scores.

Contrary to Study 2, there were some main effects of condition. These included on 2nd rank choices marginally for both mean RT, $\beta = .38$, $p < .10$, and μ, $\beta = .31$, $p < .10$ (see Table 12.17), on 3rd rank choices for τ, $\beta = .36$, $p < .05$ (see Table 12.18), on 4th rank choices for mean RT, $\beta = .44$, $p < .05$, and μ, $\beta = .43$, $p < .05$ (see Table 12.19), and marginally on 5th rank choices for μ, $\beta = .36$, $p < .10$ (see Table 12.20), with higher values in the alcohol condition. There were no other main effects of condition, βs < |.31|, ps > .10.

As with ranks apart based on the MFQ, there were a few main effects of number of ranks apart based on the MFCT for mean RT. There were effects when the 2nd ranked foundation was not chosen for 4th, $\beta = -.28$, $p < .01$ (see Table 12.19), and marginally for 5th rank choices, $\beta = -.27$, $p < .10$ (see Table 12.20). In addition, there was an interaction for 4th rank choices, with a larger difference between conditions, and higher RT in the alcohol condition, against 2nd ranked foundations, $\beta = .36$, $p < .05$, than for lower ranks. There were no other significant effects for ranks apart, βs < |.19|, ps > .10, nor interactions between condition and ranks apart, βs < |.29|, ps > .10 (see Table 12.16 – Table 12.20).

There were significant main effects for ranks apart for μ and τ . For 2nd rank choices, μ was marginally lower against 1st ranked foundations, $\beta = .22$, $p < .10$, and lower against 3rd ranked foundations, $\beta = -.28$, $p < .10$, relative to lower ranked foundations. For 3rd rank choices, τ was marginally lower against 1st ranked foundations, $\beta = -.33$, $p < .10$, and 2nd ranked foundations, $\beta = -.58$, $p < .001$, with higher μ for the latter, $\beta = .37$, $p < .05$. τ was also lower for 4th rank choices against 1st ranked, $\beta = -.38$, $p < .05$, and 2nd ranked foundations, $\beta = -.37$, $p < .05$, and for 5th rank choices against 1st ranked foundations, $\beta = -.50$, $p < .10$. There were no other main effects for μ, βs < |.32|, ps > .10, nor τ, βs < |.26|, ps > .10.

There were a number of significant interactions between ranks apart and condition. In μ, for 1st rank choices, there was a marginally smaller difference for 4th ranked relative to 5th ranked foundations, $\beta = -.54$, $p < .05$, with a higher μ in the alcohol condition. For 5th rank choices against 2nd rank choices, there is a larger difference in μ, $\beta = .50$, $p < .10$, relative to lower ranked choices, with a higher value in the alcohol condition. In τ, there is an interaction for 5th rank choices, with a larger difference between conditions in choices against 2nd ranked foundations compared with lower ranks, $\beta = -.61$, $p < .10$, with higher τ in the alcohol condition. No other interactions were significant for μ, βs < |.36|, ps > .10, nor τ, βs > |.50|, ps > .10.

As in previous studies, these models suggest weakly decreasing μ, and increasing τ, for choices between lower ranked foundations, though, as in models with ranks based on the MFQ, fewer significant planned contrasts are seen here. As in Study 2, there are no consistent differences in mean RT, μ and τ, across conditions.

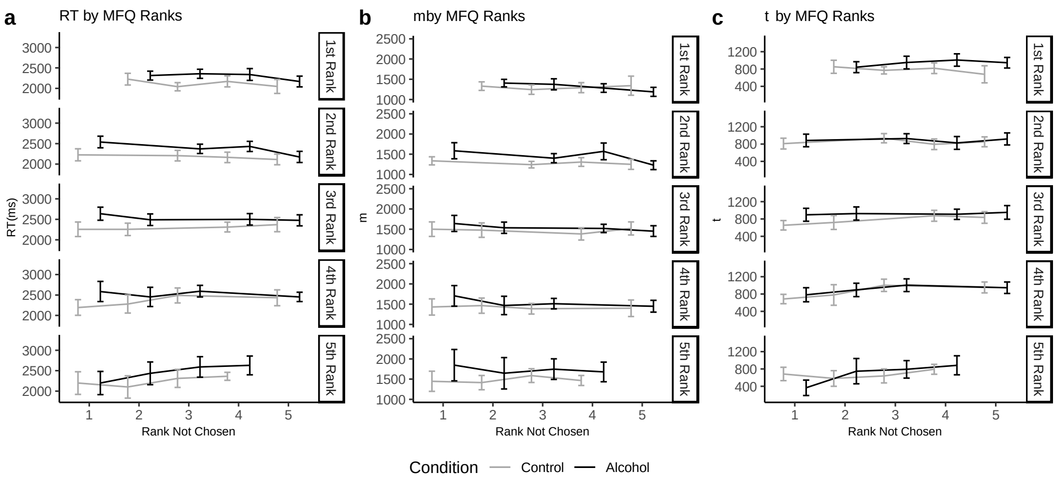

Figure 12.6. Condition and ranks chosen on MFQ, split by ranks not chosen, predicting RT (a), μ (b) and τ (c) for Study 3. Error bars denote 95% CIs, corrected for within-subject designs based on Morey

(2008).

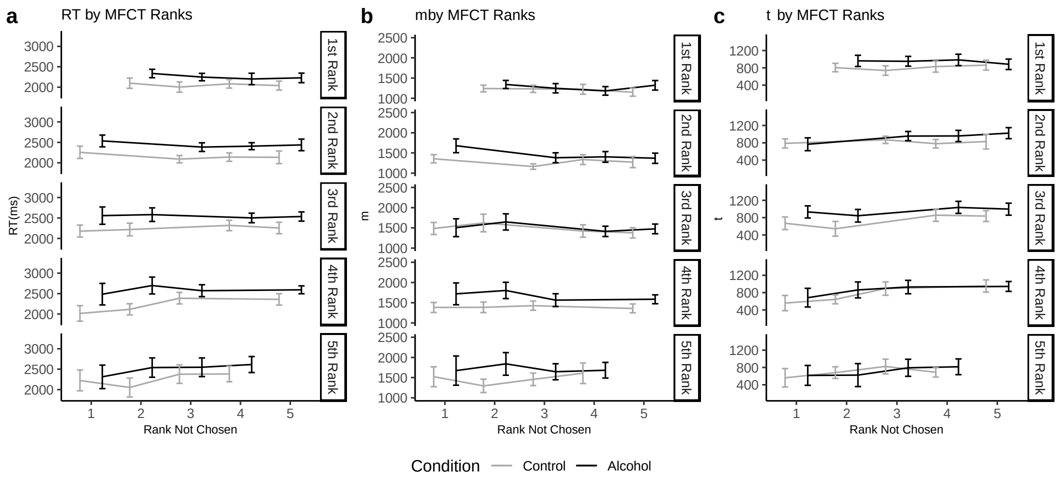

Figure 12.7. Condition and ranks chosen on MFCT, split by ranks not chosen, predicting RT (a), μ (b) and τ (c) for Study 3. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

Table 12.16. Predicting RT, μ and τ for 1st Rank choices on the MFQ and MFCT for Study 3

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	-.22 (.14)	-.05 (.13)	-.18 (.11)	-.15 (.14)	-.06 (.12)	-.11 (.12)
Condition (Alcohol v. Control)	.34† (.19)	.03 (.18)	.33* (.16)	.30 (.19)	.11 (.17)	.23 (.17)
Ranks Apart						
2 RNC v. 3, 4, 5	.21* (.09)	.13 (.13)	-.08 (.15)	.06 (.08)	.09 (.13)	.03 (.13)
3 RNC v. 4, 5	-.05 (.10)	-.07 (.14)	.11 (.17)	-.11 (.09)	.15 (.14)	-.12 (.14)
4 RNC v. 5	.23† (.13)	.08 (.19)	.19 (.22)	.03 (.11)	.19 (.16)	-.13 (.17)
Condition : Ranks Apart						
Condition : 2 RNC v. 3, 4, 5	-.18 (.12)	.17 (.18)	-.21 (.21)	.06 (.12)	.09 (.18)	-.08 (.18)
Condition : 3 RNC v. 4, 5	.16 (.14)	.32† (.19)	-.34 (.23)	.16 (.12)	-.16 (.19)	.03 (.19)
Condition : 4 RNC v. 5	.01 (.18)	.09 (.25)	-.17 (.30)	-.09 (.15)	-.54* (.23)	.26 (.23)
Random effects						
By Subject - σ						
Intercept	.86	.72	.57	.87	.70	.68
Residual	.48	.67	.80	.46	.70	.72
Marginal R^2 / Conditional R^2	.04 / .77	.02 / .54	.04 / .36	.03 / .79	.02 / .51	.02 / .48

LogLik	-321	-390	-417	-339	-430	-437
AIC	662	800	854	698	880	894
BIC	699	837	892	736	918	933

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 311 (MFQ) and 340 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. For condition: control is the reference level. Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

Table 12.17. Predicting RT, μ and τ for 2nd Rank choices on the MFQ and MFCT for Study 3

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	-.18 (.14)	-.17 (.12)	-.04 (.12)	-.19 (.14)	-.17 (.12)	-.11 (.12)
Condition (Alcohol v. Control)	.30 (.19)	.27 (.17)	.08 (.16)	.38† (.20)	.31† (.16)	.23 (.17)
Ranks Apart						
1 RNC v. 3, 4, 5	.10 (.08)	.17 (.14)	-.24 (.15)	.12 (.07)	.22† (.13)	.03 (.13)
3 RNC v. 4, 5	.11 (.09)	-.06 (.15)	.13 (.16)	-.09 (.08)	-.28* (.13)	-.12 (.14)
4 RNC v. 5	.08 (.12)	.16 (.20)	-.08 (.21)	-.02 (.10)	.20 (.16)	-.13 (.17)
Condition : Ranks Apart						
Condition : 1 RNC v. 3, 4, 5	.10 (.11)	.15 (.19)	.14 (.20)	-.03 (.10)	.28 (.18)	-.08 (.18)
Condition : 3 RNC v. 4, 5	-.03 (.12)	.13 (.20)	-.02 (.22)	.04 (.11)	.26 (.19)	.03 (.19)
Condition : 4 RNC v. 5	.16 (.16)	.36 (.27)	-.18 (.29)	-.05 (.13)	-.22 (.22)	.26 (.23)
Random effects						
By Subject - σ						
Intercept	.87	.66	.63	.89	.67	.65
Residual	.42	.71	.77	.41	.69	.73
Marginal R^2 / Conditional R^2	.03 / .82	.05 / .49	.02 / .41	.04 / .83	.06 / .51	.05 / .47
LogLik	-292	-392	-408	-306	-422	-437
AIC	603	805	836	631	865	894
BIC	641	842	873	670	903	933

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 307 (MFQ) and 338 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. For condition: control is the reference level. Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

Table 12.18. Predicting RT, μ and τ for 3rd Rank choices on the MFQ and MFCT for Study 3

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	-.13 (.14)	-.08 (.13)	-.10 (.12)	-.11 (.14)	.03 (.12)	$-.19^{\dagger}$ (.10)
Condition (Alcohol v. Control)	$.32^{\dagger}$ (.19)	.19 (.18)	.26 (.17)	.27 (.19)	.01 (.17)	$.36^{*}$ (.14)
Ranks Apart						
1 RNC v. 2, 4, 5	.004 (.09)	$.24^{\dagger}$ (.14)	$-.40^{**}$ (.15)	.05 (.10)	.17 (.16)	$-.33^{\dagger}$ (.17)
2 RNC v. 4, 5	-.11 (.10)	.16 (.15)	$-.54^{**}$ (.16)	-.04 (.10)	$.37^{*}$ (.15)	$-.58^{***}$ (.17)
4 RNC v. 5	-.08 (.13)	-.15 (.19)	-.07 (.21)	-.003 (.11)	.04 (.18)	-.07 (.19)
Condition : Ranks Apart						
Condition : 1 RNC v. 2, 4, 5	.08 (.13)	-.10 (.19)	$.37^{\dagger}$ (.21)	-.08 (.14)	-.18 (.22)	.22 (.24)
Condition : 2 RNC v. 4, 5	.23 (.14)	-.01 (.21)	$.39^{\dagger}$ (.23)	.07 (.14)	-.15 (.21)	.35 (.24)
Condition : 4 RNC v. 5	.04 (.17)	.28 (.26)	-.03 (.27)	-.05 (.15)	-.14 (.24)	-.01 (.27)
Random effects						
By Subject - σ						
Intercept	.85	.72	.64	.86	.65	.47
Residual	.45	.69	.74	.48	.76	.84
Marginal R^2 / Conditional R^2	.03 / .79	.02 / .53	.06 / .46	.02 / .77	.02 / .44	.07 / .29
LogLik	-288	-362	-369	-319	-405	-413
AIC	595	744	759	658	830	847
BIC	632	781	795	695	867	884

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 284 (MFQ) and 307 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. For condition: control is the reference level. Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

Table 12.19. Predicting RT, μ and τ for 4th Rank choices on the MFQ and MFCT for Study 3

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						

Intercept	-.04 (.15)	-.06 (.13)	-.03 (.13)	-.19 (.13)	-.19 (.12)	-.08 (.11)
Condition (Alcohol v. Control)	.17 (.20)	.16 (.17)	.09 (.18)	.44* (.18)	.43* (.16)	.12 (.16)
Ranks Apart						
1 RNC v. 2, 3, 5	-.17 (.13)	.08 (.19)	-.27 (.17)	-.19 (.13)	.14 (.18)	-.38* (.19)
2 RNC v. 3, 5	-.14 (.14)	.22 (.19)	-.64*** (.17)	-.28** (.11)	-.03 (.15)	-.37* (.16)
3 RNC v. 5	.03 (.16)	.12 (.23)	-.20 (.21)	.02 (.12)	.16 (.17)	-.26 (.18)
Condition : Ranks Apart						
Condition : 1 RNC v. 2, 3, 5	.17 (.18)	.19 (.25)	-.02 (.23)	.10 (.18)	-.07 (.25)	-.16 (.27)
Condition : 2 RNC v. 3, 5	.08 (.18)	-.32 (.26)	.39 (.24)	.39* (.15)	.36 (.22)	.11 (.23)
Condition : 3 RNC v. 5	.12 (.21)	.01 (.30)	.22 (.27)	-.08 (.17)	-.21 (.24)	.25 (.25)
Random effects						
By Subject - σ						
Intercept	.81	.58	.66	.79	.61	.55
Residual	.55	.80	.71	.52	.74	.78
Marginal R^2 / Conditional R^2	.01 / .69	.02 / .36	.06 / .49	.06 / .72	.06 / .44	.06 / .37
LogLik	-285	-334	-318	-302	-361	-367
AIC	590	688	656	625	742	754
BIC	625	723	691	661	778	790

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 248 (MFQ) and 278 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. For condition: control is the reference level. Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

Table 12.20. Predicting RT, μ and τ for 5th Rank choices on the MFQ and MFCT for Study 3

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	-.10 (.19)	-.10 (.19)	.02 (.15)	-.12 (.16)	-.07 (.15)	-.04 (.13)
Condition (Alcohol v. Control)	.27 (.26)	.37 (.25)	-.16 (.20)	.31 (.21)	.36† (.21)	-.07 (.17)
Ranks Apart						
1 RNC v. 2, 3, 4	-.10 (.17)	-.10 (.21)	-.05 (.28)	-.04 (.18)	.32 (.22)	-.50† (.27)
2 RNC v. 3, 4	-.17 (.17)	-.08 (.20)	-.08 (.28)	-.27† (.15)	-.27 (.18)	.02 (.23)
3 RNC v. 4	-.08 (.17)	.20 (.20)	-.39 (.27)	.03 (.14)	-.06 (.18)	-.03 (.22)
Condition : Ranks Apart						

Condition : 1 RNC v. 2, 3, 4	-.004 (.24)	.65* (.29)	-.89* (.39)	-.04 (.24)	.04 (.30)	.50 (.37)
Condition : 2 RNC v. 3, 4	.09 (.25)	.16 (.29)	-.01 (.39)	.29 (.21)	.50† (.26)	-.61† (.32)
Condition : 3 RNC v. 4	-.01 (.22)	-.13 (.26)	.13 (.36)	-.10 (.19)	.03 (.24)	-.15 (.30)
Random effects						
By Subject - σ						
Intercept	.81	.77	.44	.80	.72	.44
Residual	.51	.62	.85	.55	.68	.87
Marginal R^2 / Conditional R^2	.03 / .72	.05 / .63	.09 / .28	.03 / .69	.05 / .55	.05 / .24
LogLik	-168	-186	-206	-246	-272	-292
AIC	355	392	431	511	564	604
BIC	385	422	462	545	597	637

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 152 (MFQ) and 212 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. For condition: control is the reference level. Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

13 Appendix 3: Chapter 7

Structure of MFCT

We replicated analyses regarding the structure of the task to data from the deliberation version of the MFCT.

Valence score and length of items

As in previous studies, we fit a logistic model predicting whether an item was chosen based on valence score and length (Table 13.1). Items with higher valence scores and longer in length are more likely to be chosen.

Table 13.1. Choice by valence score and length for Study 4

	Model	
	β	OR
Fixed effects		
Intercept	.03 (.24)	1.03
Valence Score	1.54*** (.03)	4.65
Length	.41*** (.04)	1.51
Valence Score : Length	.40*** (.03)	1.49
Random effects - σ		
Subject	< .001	
Item Pair	1.27	
Valence	.11	
Action	.29	
Marginal R^2 / Conditional R^2	.30 / .51	
LogLik	-16,768	
AIC	33,553	
BIC	33,618	

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 26,568. OR – Odds ratios. Fixed and random effects for logistic model predicting choice. Predictors have been standardised. For fixed effects, *SE* is provided in parentheses. Pseudo R^2 calculated using the delta method (Nakagawa et al., 2017).

Valence scores were higher for individualising foundations than for binding foundations, and this is reflected in separate models predicting valence score for choices (Table 13.2). For both chosen, β = -1.86, $p < .001$, and not chosen items, β = -1.76, $p < .001$, binding foundations had lower valence scores than individualising foundations, and were shorter in length for both chosen, β = -.19, $p < .001$, and not chosen items, β = -.21, $p < .001$.

Table 13.2. Valence score and length of items by foundation for Study 4

	Models			
	Valence Score		Length	
	Chosen	Not Chosen	Chosen	Not Chosen
Fixed effects				
Intercept	-.20*** (.01)	.18*** (.01)	-.02* (.01)	.03*** (.01)
Foundation				
Binding v. Individualising	-1.86*** (.01)	-1.76*** (.02)	-.19*** (.02)	-.21*** (.02)
Fairness v. Care	.09*** (.01)	.05*** (.01)	.03* (.01)	-.15*** (.02)
Loyalty v. Authority	.37*** (.01)	.31*** (.01)	.02 (.02)	-.07*** (.01)
Purity v. Authority	-.22*** (.01)	.01 (.01)	-.03 (.02)	-.19*** (.01)
Random effects				
By Subject - σ				
Intercept	.03	< .001	< .001	< .001
Item Pair	.36	.28	.68	.56
Valence	.36	.54	.51	.57
Action	.36	.37	.51	.57
Residual	.13	.03	.05	.03
Marginal R^2/ Conditional R^2	.60 / .98	.49 / >.99	.01 / >.99	.04 / >.99
LogLik	-12,775	-14,373	-18,807	-18,600
AIC	25,570	28,767	37,635	37,221
BIC	25,645	28,842	37,710	37,296

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 13,284. Fixed and random effects for separate models predicting valence score and length of chosen and not chosen items in a given trial. Outcome variables have been standardised. Individualising, care and authority are reference levels. For fixed effects, *SE* is provided in parentheses.

The difference in valence score for the items in a given trial also had an effect on RT, β = -.13, $p < .001$, with quicker choices as the difference in valence score between items increased (Table 13.3). There was also an effect for the difference in the length of items on RT, β = .06, $p < .001$, with slower choices between items with a larger difference in length.

Table 13.3. RT by difference in valence score and length for Study 4

	Models	
	log RT	
Fixed effects		
Intercept	.003 (.05)	.003 (.05)
Difference in Valence Score	-.13*** (.01)	
Difference in Length		.06*** (.01)
Random effects		
By Subject - σ		
Intercept	.46	.46
Item Pair	.50	.50
Valence	.50	.50
Action	.50	.50
Residual	.19	.19
Marginal R^2 / Conditional R^2	.02 / .96	.003 / .96
LogLik	-17,321	-17,428
AIC	34,655	34,871
BIC	34,708	34,923

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 13,284. Fixed and random effects for separate models predicting standardised log RT from standardised absolute differences in valence score and length between items in a given trial. For fixed effects, *SE* is provided in parentheses.

These effects of valence score and length found in previous studies are largely replicated in Study 4. Also as in the preceding studies, this is likely impacted by differences across foundations, with items for individualising foundations tending to be rated as are more positive/negative, and be longer in length.

Effect of blocks

Analyses assessed whether condition and blocks on the MFCT had any effect on responses and RT patterns. Figure 13.1 shows a histogram of the distribution of RTs across all trials in the deliberation condition.

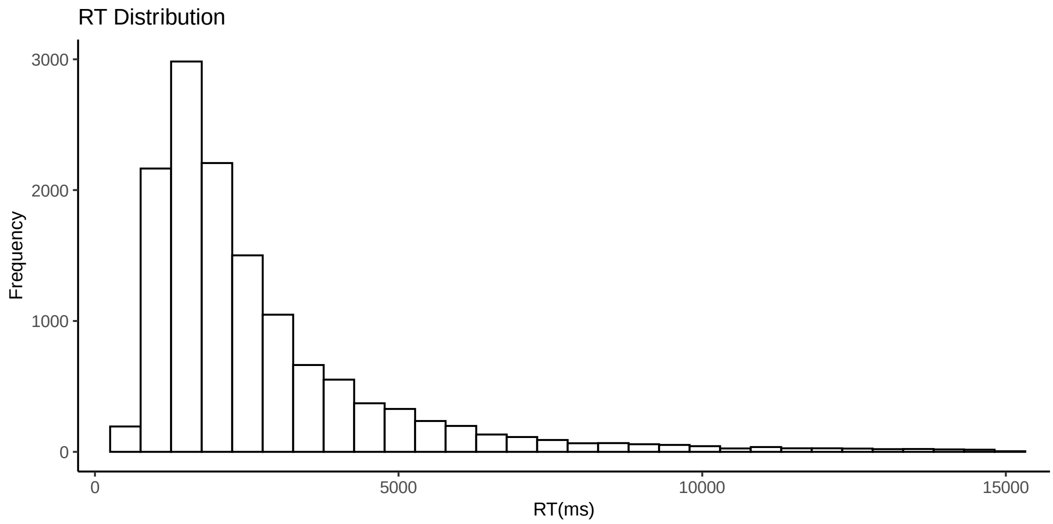

Figure 13.1. Distribution of RTs across all trials in Study 4

As in previous studies, neither the valence, nor the action formulation of items, nor the interaction between valence and action had an effect on MFCT scores. However, the interaction between valence and action did affect RT, β = -.10, p = < .01.with passive items being faster in the virtue block.

Also as in previous, there was a significant effect of foundation on MFCT scores, with binding foundations being chosen less, β = -.78, p < .001, and slower, β = .26, p < .001, than individualising foundations. As in previous studies, this likely reflects that most participants were liberal, prioritising individualising foundations. Further significant interactions between valence, action, and foundation can be seen in Table 13.4, Figure 13.2 and Figure 13.3.

Table 13.4. MFCT score and RT by blocks and foundation for Study 4

	Models	
	MFCT Score	log RT
Fixed effects		
Intercept	-.002 (.04)	.27*** (.05)
Valence (Virtue v. Vice)	-.0003 (.05)	-.10*** (.02)
Action (Passive v. Active)	-.003 (.05)	-.32*** (.02)
Foundation		
Binding v. Individualising	-.78*** (.09)	.26*** (.04)
Fairness v. Care	-.67*** (.06)	.11*** (.02)

Loyalty v. Authority	.16* (.06)	-.03 (.03)
Purity v. Authority	-.30*** (.06)	.05 (.03)
Valence : Action	.004 (.07)	-.10** (.03)
Valence : Foundation		
Valence : Binding v. Individualising	-.88*** (.12)	-.07 (.05)
Valence : Fairness v. Care	.78*** (.08)	-.14*** (.03)
Valence : Loyalty v. Authority	.38*** (.09)	.03 (.04)
Valence : Purity v. Authority	.42*** (.09)	-.04 (.04)
Action : Foundation		
Action : Binding v. Individualising	-.71*** (.12)	.07 (.05)
Action : Fairness v. Care	-.03 (.08)	.04 (.03)
Action : Loyalty v. Authority	.34*** (.09)	-.03 (.04)
Action : Purity v. Authority	.003 (.09)	-.02 (.05)
Valence : Action : Foundation		
Valence : Action : Binding v. Individualising	1.40*** (.17)	-.16* (.07)
Valence : Action : Fairness v. Care	-.41*** (.11)	.08† (.04)
Valence : Action : Loyalty v. Authority	-1.03*** (.13)	.09 (.06)
Valence : Action : Purity v. Authority	-.63*** (.13)	-.01 (.07)
Random effects		
By Subject - σ		
Intercept	< .001	.46
Residual	.72	.86
Marginal R^2 / Conditional R^2	.48 / .48	.06 / .27
LogLik	-1,863	-16,970
AIC	3,771	33,984
BIC	3,891	34,149

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 1,700 (MFCT Score) and 13,284 (log RT). Fixed and random effects for separate models predicting MFCT score and log RT. Outcome variables have been standardised. For RT model, foundation represents the foundation of the item chosen in a given trial. Planned contrasts for foundation compare individualising to binding foundations (with the former as the reference level), and then compare Care to Fairness (former as reference level), and Authority to Loyalty and Purity (Authority as reference level). For valence and action, vice and active are reference levels. For fixed effects, *SE* is provided in parentheses.

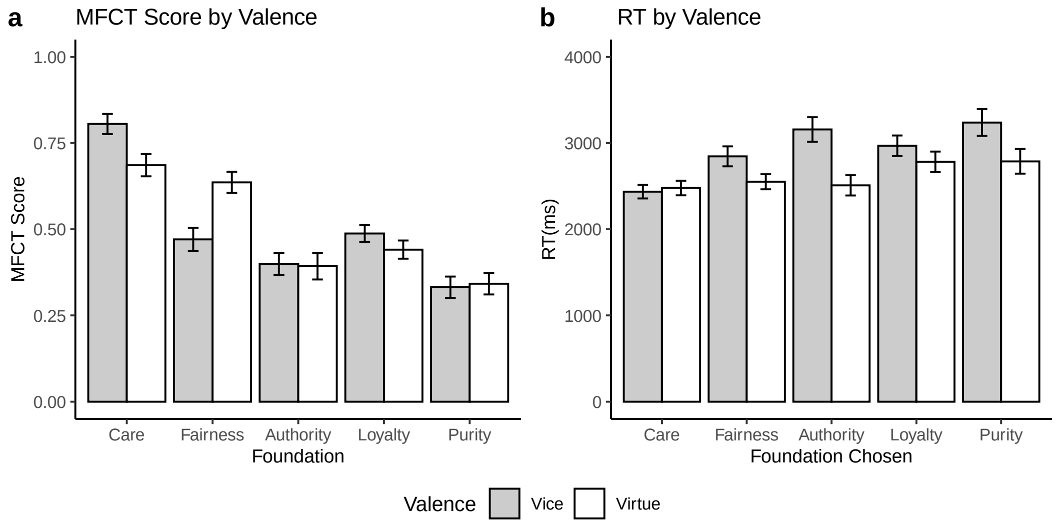

Figure 13.2. MFCT score (a) and RT (b) by valence block and foundation in Study 4. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

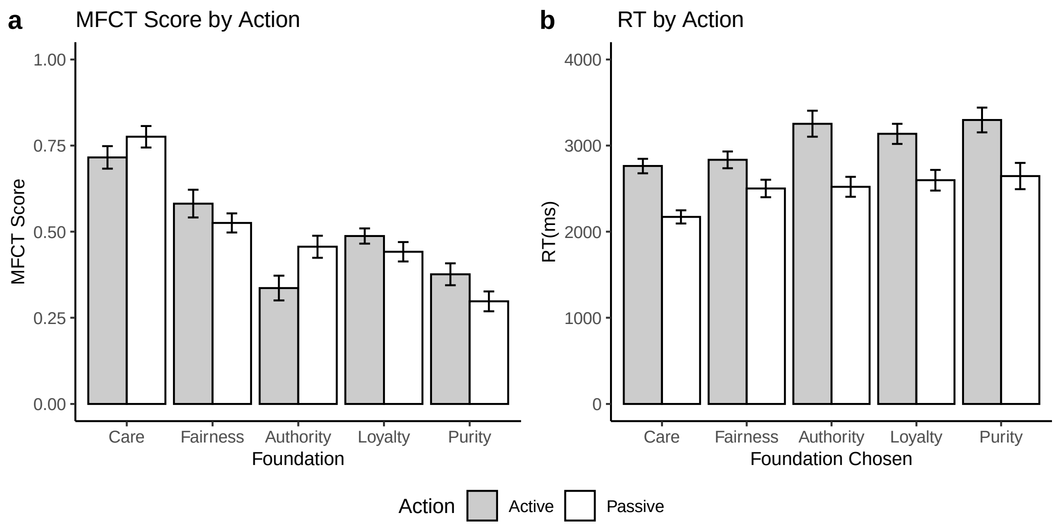

Figure 13.3. MFCT score (a) and RT (b) by action block and foundation in for Study 4. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

Within-subject mean RTs and Ex-Gaussian parameters were fit for each block (see Table 13.5 and Figure 13.4). Contrary to previous studies, the interaction between valence and action did not predict mean RT, μ, or τ, βs < |.29|, ps > .10. There were main effects for valence on mean RT, β = -.18, p < .05, and τ, β = -.25, p < .01, with higher values in the vice blocks. There were also higher values for active blocks across all three models, βs < |.41|, ps < .001.

Table 13.5. RT, μ and τ by blocks for Study 4

	Models		
	log RT	log μ	log τ
Fixed effects			
Intercept	.39*** (.10)	.34** (.10)	.35** (.11)
Valence (Virtue v. Vice)	-.18* (.08)	.01 (.10)	-.25** (.09)
Action (Passive v. Active)	-.56*** (.08)	-.63*** (.10)	-.41*** (.09)
Valence : Action	-.09 (.11)	-.11 (.14)	-.07 (.13)
Random effects			
By Subject - σ			
Intercept	.80	.70	.74
Residual	.50	.62	.62
Marginal R^2 / Conditional R^2	.11 / .75	.12 / .61	.07 / .62
LogLik	-350	-398	-399
AIC	712	808	809
BIC	735	831	832

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 340. Fixed and random effects for separate models predicting log RT, μ and τ. Outcome variables have been standardised. For valence and action, vice and active are reference levels. For fixed effects, *SE* is provided in parentheses.

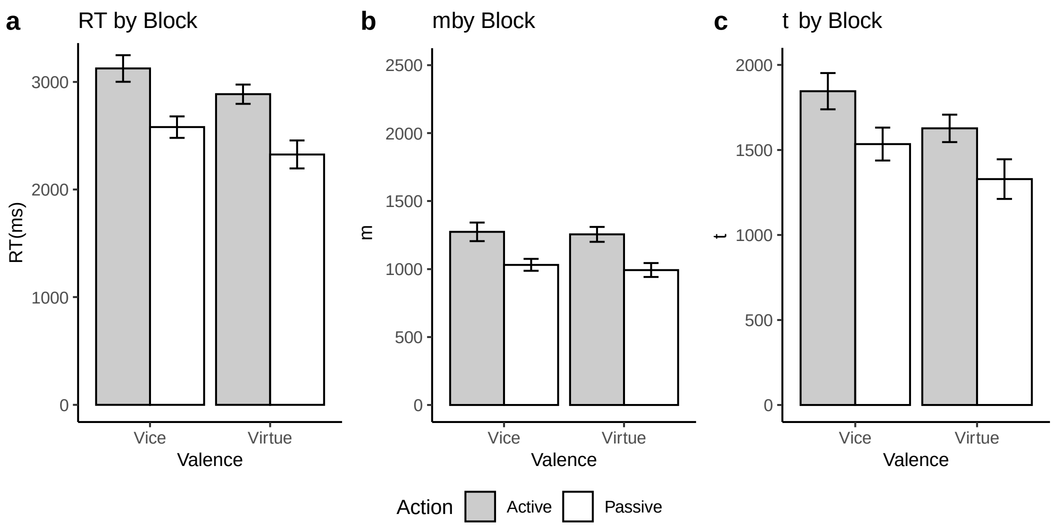

Figure 13.4. Mean RT (a), μ *(b)* and τ (c) by blocks in Study 4. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

Consistent with previous studies, these analyses indicate that the block structure of the task impacts response patterns and RTs on the MFCT, with quicker and easier choices between virtue and passive items.

We assessed internal reliability of the full MFCT and for each block, collapsing across conditions. Table 13.6 shows split-half reliability coefficients. Reliability is acceptable for the full task, and across blocks.

Table 13.6. Bootstrapped split-half reliability across blocks for Study 4

	r_{Boot}	Bias	95% CI of r	$SE\ r_{Boot}$
Study 4 (N = 85)				
Full Task	.85	-.004	[.80, .90]	.02
Vice	.82	-.01	[.78, .88]	.03
Virtue	.81	-.04	[.77, .94]	.05
Active	.80	-.02	[.75, .88]	.04
Passive	.79	.02	[.70, .83]	.03

Note. Bootstrapped with 5,000 iterations.

Correlating MFQ and MFCT Scores across blocks

As in previous studies, there was no evident difference in correlations between the active and passive blocks, *95% CI* [-.10, .14]. However, unlike previous, correlations were higher in virtue blocks, *95% CI* [-.31, -.07].

Table 13.7*.* Correlations between MFQ and MFCT scores across blocks for Study 4

	Sample r_{τ}	$r_{\tau Boot}$	Bias	95% CI of r_{τ}	SE $r_{\tau Boot}$	95% CI of Difference
Study 4 (N = 85)						
Vice	.45	.46	-.016	[.40, .55]	.040	[-.31, -.07]
Virtue	.62	.60	.023	[.52, .64]	.032	
Active	.52	.56	-.034	[.52, .69]	.040	[-.10, .14]
Passive	.51	.53	-.024	[.49, .62]	.034	

Note. Bootstrapped with 5,000 iterations. CIs are the Bias Corrected Accelerated (BCa) intervals

Predicting RT on the MFCT

As participants completing the deliberated version of the MFCT were instructed to take time to consider their choices, we had no specific predictions as to how RT patterns will differ from the normal version of the task. Exploratory analyses conducted in previous studies were replicated on a combined dataset (N = 253), implementing control and deliberation conditions.

Difference in foundation scores predicting RT

Separate multilevel models (see Table 13.8) were fit to predict RT from the difference between MFQ and MFCT scores, entered into the models as linear (x) and quadratic (x_2) terms, predicting that RT will be highest when the difference is 0 indicating that two foundations are equally valued, and that the effect on RT would be non-linear. Figure 13.5 plots these quadratic regressions.

As in Study 1 and 2, only the linear term was significant when difference was based on MFQ scores, $\beta = -.07$, $p < .01$, while the quadratic term was significant for difference in MFCT scores, $\beta = -.02$, $p < .001$. As in previous studies, these effects are small. There were effects of condition in both models, βs > .13, ps < .10, with longer RTs in the deliberation condition. There were no evident interactions between condition and any other terms in the models, βs < |.03|, ps > .10.

Table 13.8. Predicting RT from condition and difference in MFQ and MFCT scores for Study 4

	Models	
	log RT	
Fixed effects		
Intercept	.05 (.04)	.05 (.04)
Condition (Alcohol v. Control)	$.13^{\dagger}$ (.08)	$.17^{*}$ (.08)
Difference in MFQ Scores	$-.07^{**}$ (.02)	
Difference in MFQ Scores^2	.002 (.01)	
Condition : Difference in MFQ Scores	.02 (.04)	
Condition : Difference in MFQ Scores^2	-.01 (.01)	
Difference in MFCT Scores		-.02 (.02)
Difference in MFCT Scores^2		$-.02^{***}$ (.01)
Condition : Difference in MFCT Scores		-.03 (.04)
Condition : Difference in MFCT Scores^2		.004 (.01)
Random effects		
By Subject - σ		
Intercept	.53	.53
Foundation Combination	< .001	< .001

Valence	< .001	< .001
Action	.35	.34
Residual	.77	.77
Marginal R^2 / Conditional R^2	.01 / .41	.02 / .41
LogLik	-50,074	-49,984
AIC	100,169	99,989
BIC	100,264	100,084

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 40,128. Fixed and random effects for separate models predicting log RT. Outcome variables have been standardised. Quadratic models fit terms for difference in scores (x) and squared difference in scores (x^2) between foundations in a trial. In order to preserve a minimum value of 0 interpretable as no difference between scores for the quadratic term, difference predictors in these models were scaled by SD without centring. For condition: control is the reference level. For fixed effects, *SE* is provided in parentheses.

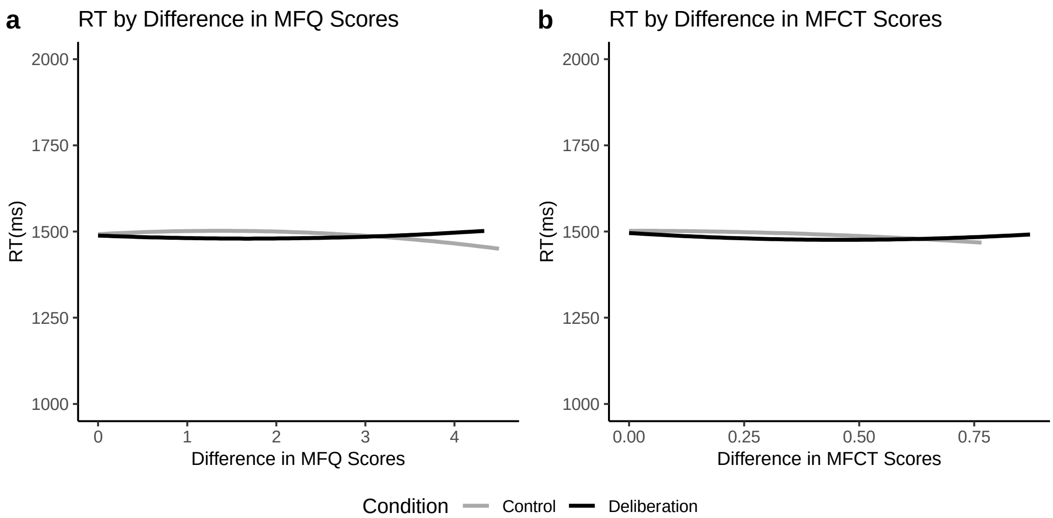

Figure 13.5. Predicting RT for Study 4 with quadratic models for (a) difference in MFQ scores and (b) difference in MFCT scores between foundations in a trial. Grey areas represent 95% CI boundaries.

Ranks apart predicting RT

As in previous studies, multilevel models were fit to predict RT, μ and τ from number of ranks apart, with a set of planned contrasts (Helmert coding) to test whether the former increases with fewer ranks apart. A total of 124 participants had equally scored foundations on the MFQ, and 37 on the MFCT, and as in previous, these were dropped from models. Figure 13.6 and Figure 13.7 show histograms for within-subject mean RTs, μ and τ calculated for ranks apart categories based on the MFQ and MFCT, respectively.

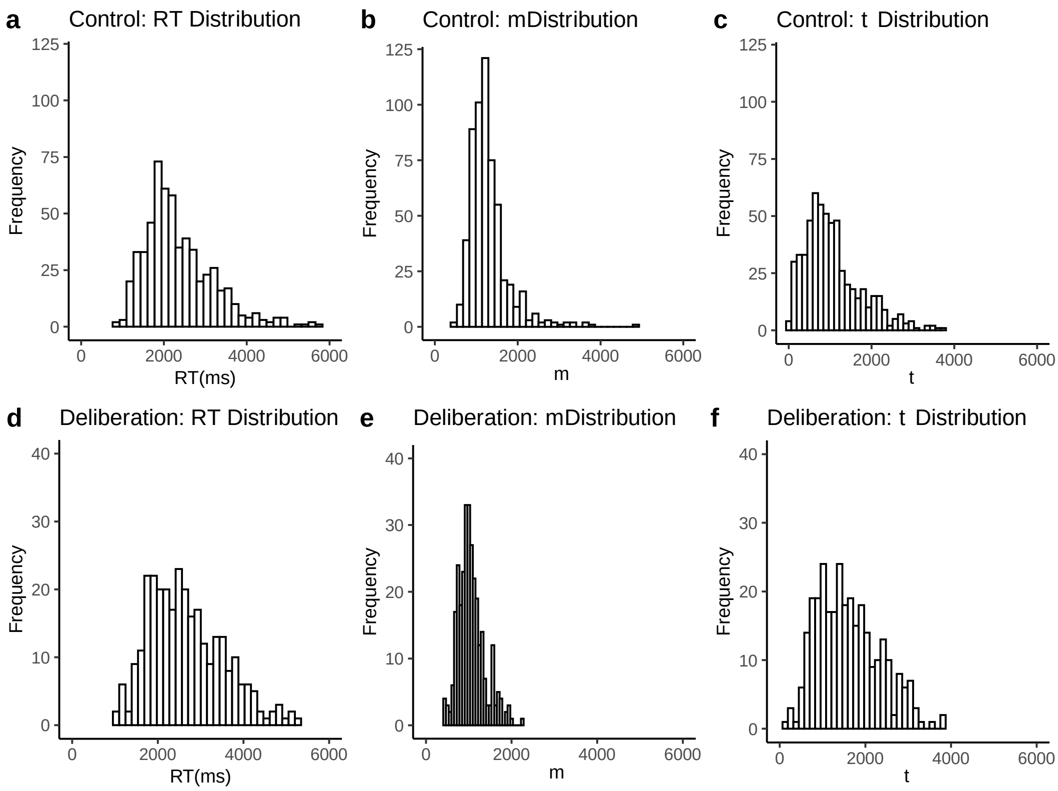

Figure 13.6. Distribution of RT (a), μ (b) and τ (c) across MFQ rank apart categories in Study 4

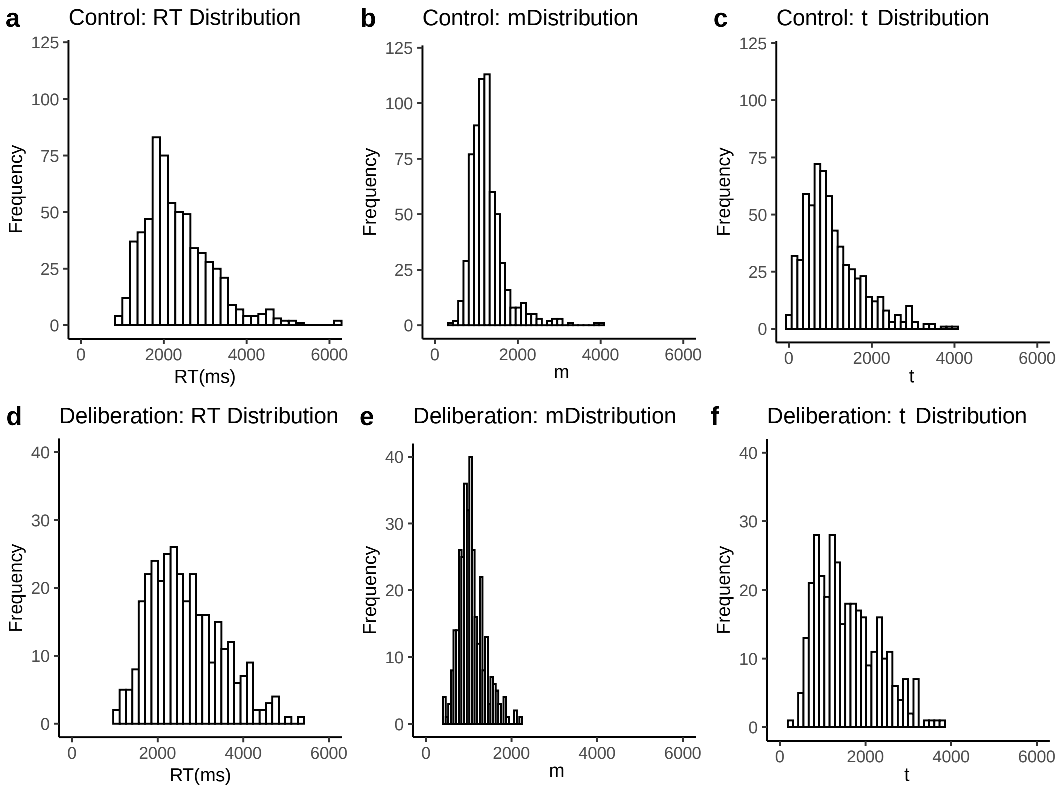

Figure 13.7. Distribution of RT (a), μ (b) and τ (c) across MFCT rank apart categories in Study 4

Ranks apart on MFQ

As in previous studies, a trend of decreasing RT and τ, as the number of ranks apart increases, can be seen in Figure 13.8 (panels a and c). Values were higher in one rank, βs > .14, *p*s < .001, and two rank apart choices, βs > .07, *p*s < .05, relative to further apart choices (see Table 13.9). This was not reflected in μ, βs < .06, *p*s > .10.

There were clear effects of condition, with higher mean RT, $\beta = .38$, $p < .01$, and τ , $\beta = .72$, $p < .001$, and lower μ, $\beta = -.54$, $p < .001$, in the deliberation condition. Interactions between condition and number of ranks apart for two rank apart choices and lower in both mean RT and τ, βs > .19, *p*s < .10, that reflect steeper downward trends in the deliberation version of the task.

Ranks apart on MFCT

Similar patterns can be seen when ranks apart are based on the MFCT (see Figure 13.9). Here, all comparisons are significant for mean RT, βs > .12, *p*s < .001, and in one and two rank apart choices for τ, βs > .21, *p*s < .001, indicating the downward trend. There were higher μ values in one rank apart choices, $\beta = .14$, $p < .05$, however this did not extend to other comparisons, βs < .10, ps > .10.

Again, there were clear main effects of condition, with higher mean RT, $\beta = .40$, $p < .01$, and τ, $\beta = .74$, $p < .001$, and lower μ, $\beta = -.57$, $p < .001$, in the deliberation condition. All interactions were significant for mean RT, βs > .09, $p < .10$, again reflecting a steeper downward trend in the deliberation condition. However, there were no evidence of interactions for τ, $\beta s < .12$, $p < .10$.

Table 13.9. Predicting RT, μ and τ from condition and ranks apart on the MFQ and MFCT for Study 4

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	-.15* (.07)	.18** (.06)	-.27*** (.06)	-.15* (.07)	.19** (.06)	-.26*** (.06)
Condition (Delib. v. Control)	.38** (.13)	-.54*** (.11)	.72*** (.11)	.40** (.13)	-.57*** (.11)	.74*** (.11)
Ranks Apart						
1 RA v. 2, 3, 4	.14*** (.03)	.03 (.06)	.18*** (.05)	.20*** (.03)	.14* (.05)	.24*** (.05)
2 RA v. 3, 4	.07* (.03)	.003 (.06)	.14* (.06)	.14*** (.03)	.03 (.06)	.21*** (.05)
3 RA v. 4	.02 (.04)	.06 (.08)	.02 (.08)	.12*** (.04)	.10 (.07)	.03 (.06)
Condition : Ranks Apart						
Condition : 1 RA v. 2, 3, 4	.06 (.05)	-.09 (.10)	.04 (.09)	.09† (.05)	-.18† (.09)	.03 (.08)
Condition : 2 RA v. 3, 4	.20*** (.05)	-.21† (.11)	.19† (.10)	.20*** (.05)	.04 (.10)	.07 (.09)
Condition : 3 RA v. 4	.21** (.07)	-.20 (.14)	.28* (.13)	.10† (.06)	-.005 (.12)	.12 (.10)
Random effects						
By Subject - σ						
Intercept	.92	.74	.73	.92	.75	.77
Residual	.29	.61	.56	.30	.60	.52
Marginal R^2 / Conditional R^2	.05 / .92	.08 / .63	.14 / .68	.06 / .91	.08 / .64	.15 / .73
LogLik	-607	-1,040	-984	-669	-1,129	-1,020
AIC	1,234	2,099	1,988	1,359	2,278	2,059
BIC	1,282	2,147	2,035	1,407	2,327	2,108

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 883 (MFQ) and 970 (MFCT). RA – Ranks Apart. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. Helmert coding compares each rank apart category to the mean of the subsequent categories. For condition: control is the reference level. For fixed effects, *SE* is provided in parentheses.

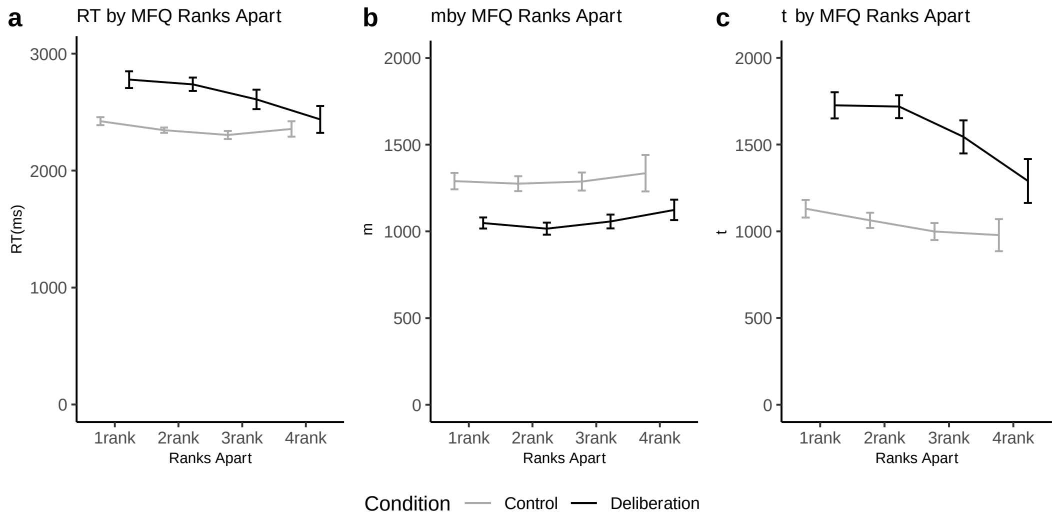

Figure 13.8. Condition and ranks apart on MFQ predicting RT (a), μ (b) and τ (c) for Study 4. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

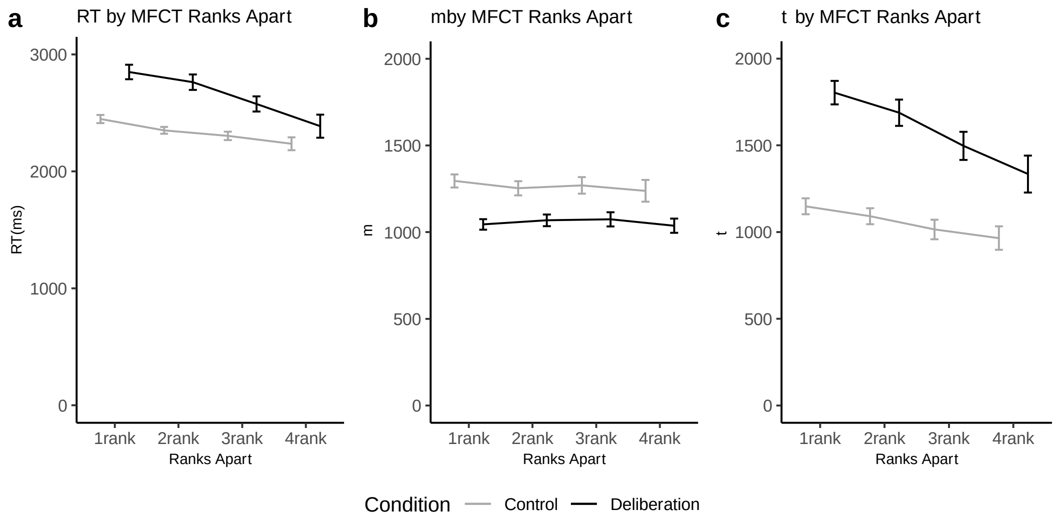

Figure 13.9. Condition and ranks apart on MFCT predicting RT (a), μ (b) and τ (c) for Study 4. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

These analyses broadly replicate the patterns found in previous studies, reflecting a downward trend in RT and τ, tracking decreasing conflict in decisions between foundations that differ more in value. This pattern becomes clearer when participants are instructed to deliberate their responses. This trend is not evident in μ, isolating the time to physically make responses. However, contrary to previous studies manipulating cognitive load, which found no effects of condition, μ was lower in the deliberative version of the task relative to the normal speeded version.

Weighted difference scores predicting RT

As in previous studies, a difference score was created for each inter-foundation combination to weight by the mean score of foundations in a choice. Difference scores based on the MFQ and on the MFCT correlated at $r = .63$, $p < .001$, *95% CI* [.60, .66].

Separate multilevel models (see Table 13.10) were fit to predict RT from difference scores based on the MFQ and MFCT. There were no effects for MFQ or MFCT difference scores, βs < |.01|, ps < .10. There is an interaction between condition and MFCT difference scores, $\beta = .02$, $p < .05$, with a steeper slope in the control condition. As in previous, these results may indicate that the weighted difference score does not adequately capture differences in value.

Table 13.10. Predicting RT from condition and difference score based on MFQ and MFCT for Study 4

	Models	
	log RT	
Fixed effects		
Intercept	-.04 (.04)	-.04 (.04)
Condition (Deliberation v. Control)	.13† (.07)	.13† (.07)
Difference Score MFQ	-.01 (.01)	
Condition : Difference Score MFQ	.02 (.02)	
Difference Score MFCT		.001 (.01)
Condition : Difference Score MFCT		.02* (.01)
Random effects		
By Subject - σ		
Intercept	.52	.53
Foundation Combination	< .001	< .001
Valence	< .001	< .001
Action	.35	.35
Residual	.77	.77
Marginal R^2 / Conditional R^2	.004 / .40	.004 / .40
LogLik	-50,143	-50,141

AIC	100,304	100,300
BIC	100,382	100,378

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 40,128. Fixed and random effects for separate models predicting log RT. Outcome variables have been standardised. Difference score calculated as *mean*($Score_1$, $Score_2$) * (1 - *abs*($Score_1$ - $Score_2$)). For condition: control is the reference level. For fixed effects, *SE* is provided in parentheses.

A further set of models were fit, collapsing RT and fitting within-subject Ex-Gaussian parameters for each inter-foundation combination (see Table 13.11). Here, there was a significant effect of difference score based on the MFQ, with decreasing μ, $\beta = -.06$, $p < .01$, though no other effects or interactions were significant, βs < |.04|, *p*s > .10. Again, there were main effects of condition, with increased mean RT, βs = .65, *p*s < .001, and τ, βs > .69, *p*s < .001, and decreased μ, βs < -.37, *p*s < .001, in the deliberation condition.

Table 13.11. Predicting RT, μ and τ from condition and diff. score based on MFQ and MFCT for Study 4

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	$-.22^{***}$ (.07)	$.12^{*}$ (.06)	$-.23^{***}$ (.05)	$-.22^{***}$ (.07)	$.13^{*}$ (.06)	$-.23^{***}$ (.05)
Condition	$.65^{***}$ (.11)	$-.37^{***}$ (.10)	$.69^{***}$ (.09)	$.65^{***}$ (.11)	$-.38^{***}$ (.10)	$.70^{***}$ (.09)
Difference Score MFQ	-.02 (.01)	$-.06^{**}$ (.02)	.01 (.02)			
Condition : Diff. Score MFQ	.01 (.03)	.04 (.04)	-.01 (.04)			
Difference Score MFCT				.02 (.01)	-.03 (.02)	.02 (.02)
Condition : Diff. Score MFCT				.03 (.02)	.02 (.03)	.02 (.03)
Random effects						
By Subject - σ						
Intercept	.84	.68	.67	.84	.68	.67
Foundation Combination	.40	.65	.61	.40	.65	.61
Residual	.20	.28	.26	.20	.28	.26
Marginal R^2 / Conditional R^2	.09 / .96	.04 / .92	.11 / .93	.09 / .96	.03 / .92	.11 / .93

Log Likelihood	-2,032	-3,006	-2,854	-2,029	-3,010	-2,853
Akaike Inf. Crit.	4,079	6,027	5,722	4,071	6,034	5,720
Bayesian Inf. Crit.	4,120	6,068	5,763	4,112	6,075	5,761

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 2,530. Fixed and random effects for separate models predicting log RT, μ and τ, estimated for each foundation combination. Outcome variables have been standardised. Difference score calculated as *mean*($Score_1$, $Score_2$) * (1 - *abs*($Score_1$ - $Score_2$)). For condition: control is the reference level. For fixed effects, *SE* is provided in parentheses.

Weighted ranks apart predicting RT

We fit models (see Table 13.12) that included a bias term to weight number of ranks apart by the mean rank for foundations in a choice.

As in previous studies, for ranks based on both MFQ and MFCT scores, RT is negatively predicted by mean rank, βs < -.05, *p*s < .001, and by number of ranks apart, βs < -.04, *p*s < .001, indicating that as the value, and the difference in value, of foundations in a choice increases, time to make the choice decreases. However, as in previous studies, there was no evidence of an interaction between these for ranks based on either MFQ or MFCT scores, βs < |.003|, *p*s > .10.

There were marginal main effects of condition, βs = .13, *p*s < .10, and interactions between condition and ranks apart on the MFQ, β = -.02, p < .10, and on the MFCT, β = -.03, p < .01, indicating a steeper negative slope in the deliberation condition. There was a significant three-way interaction between condition, mean rank, and ranks apart on the MFCT, β = -.04, p < .05. No other interactions including condition were significant, βs < |.02|, *p*s > .10.

Table 13.12. Predicting RT from condition, mean rank, and ranks apart on the MFQ and MFCT for Study 4

	Models	
	log RT	
	MFQ	MFCT
Fixed effects		
Intercept	-.04 (.04)	-.04 (.04)
Condition (Deliberation v. Control)	$.13^{\dagger}$ (.07)	$.13^{\dagger}$ (.07)
Mean Rank	$-.05^{***}$ (.01)	$-.06^{***}$ (.01)
Ranks Apart	$-.04^{***}$ (.01)	$-.06^{***}$ (.01)
Condition : Mean Rank	.01 (.01)	-.02 (.01)
Condition : Ranks Apart	$-.02^{\dagger}$ (.01)	$-.03^{**}$ (.01)
Mean Rank : Ranks Apart	-.003 (.01)	-.003 (.01)
Condition : Mean Rank : Ranks Apart	.02 (.02)	$-.04^{*}$ (.02)
Random effects		
By Subject - σ		
Intercept	.53	.53
Foundation Combination	< .001	< .001
Valence	< .001	< .001
Action	.35	.34
Residual	.77	.77
Marginal R^2 / Conditional R^2	.01 / .40	.01 / .40
LogLik	-50,069	-49,993
AIC	100,164	100,013
BIC	100,276	100,124

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 40,128. Fixed and random effects for separate models predicting log RT. Outcome variables and predictors have been standardised. Mean rank calculated as *mean*($Rank_1$, $Rank_2$), of reversed ranks, such that higher mean rank indicates more valued foundations. For condition: control is the reference level. For fixed effects, *SE* is provided in parentheses.

Ranks apart split by rank chosen predicting RT

Multilevel models were fit to predict RT, μ and τ for each rank, based on the MFQ and the MFCT, that was chosen from the rank not chosen in a given trial (see Table 13.13 to Table 13.17). As in previous analyses, equally ranked choices were dropped, and a set of planned contrasts compare each rank category to the mean of the subsequent rank categories.

Ranks apart split by rank chosen on MFQ

Figure 13.10 shows plots for RT, μ and τ for each rank chosen, based on MFQ scores. Mean RT, βs > .26, *p*s < .10, and τ, βs > .37, *p*s < .01, were higher in the deliberation condition for all choices, with lower μ in 1st., 3rd and 4th rank choices , βs < -.18, *p*s < .10.

As in previous studies, there appears to be a shift from a weak downward trend in mean RT and τ, to a weak upward trend, as the value of the foundation are chosen decreases. However, contrasts in models do not always reflect this.

When highest valued foundations (1st rank) were chosen, mean RT and μ were higher, βs > .13, *p*s < .01, against 2nd ranked foundations, with no significant contrasts for τ, βs < |.03|, *p*s > .10. For 2nd rank choices, μ was higher, β = .16, *p* < .05, while τ was lower, β = -.24, *p* < .001, when the 1st rank was not chosen, with no effect for RT, βs < |.08|, *p*s > .10. For both 3rd and 4th rank choices, τ was lower against both 1st ranked, βs < -.20, *p*s < .05, and 2nd ranked foundations, βs = -.26, *p*s < .01, with a marginal contrast in 4th rank choices against 3rd ranked foundations, β = -.20, *p* < .10. For 5th rank choices, τ was marginally lower against both 2nd ranked, β = -.21, *p* < .10, and 3rd ranked foundations, β = -.36, *p* < .01. There were no contrasts for mean RT and μ, that reflected these trends, βs < |.15|, *p*s > .10. Mean RT, βs > .26, *p*s < .10, and τ, βs > .37, *p*s < .01, were higher in the deliberation condition for all choices, with lower μ in 1st., 3rd and 4th rank choices , βs < -.18, *p*s < .10. There were a number of significant interactions between ranks apart and condition, that most consistently appeared in choices against higher ranked foundations.

As in previous studies, these models suggest a weak pattern with μ decreasing, and τ increasing for choices between lower ranked foundations. As in Study 2, there are no consistent differences in mean RT, μ and τ, across conditions.

Ranks apart split by split by rank chosen on MFCT

Figure 13.11 shows plots for RT, μ and τ for each rank chosen, based on MFCT scores. Mean RT, βs > .26, *p*s < .05, and τ, βs > .45, *p*s < .001, were higher in the deliberation condition for all choices, with marginally lower μ in 1st, and 5th rank choices , βs < -.21, *p*s < .10.

When highest valued foundations (1st rank) were chosen, mean RT and μ were higher, βs > .15, *p*s < .01, against 2nd ranked foundations, with no significant contrasts for τ, βs < |.08|, *p*s > .10. For 2nd rank choices, μ was higher, β = .18, $p < .01$, when the 1st rank was not chosen, with no effect for RT, βs < |.05|, *p*s > .10, nor τ, βs < |.08|, *p*s > .10. For both 3rd and 4th rank choices, τ was lower against both 1st ranked, βs < -.33, *p*s < .001, and 2nd ranked foundations, βs < -.37, *p*s < .001, with a contrast in 4th rank choices against 3rd ranked foundations, β = -.22, $p < .05$. μ was higher against both 1st ranked, βs = .23, *p*s < .01, and 2nd ranked foundations, βs > .17, *p*s < .10. For 5th rank choices, all contrast were significant for τ was lower against both 2nd ranked, β = -.22, $p < .10$, and 3rd ranked foundations, β = -.22, $p < .05$. There were fewer significant interactions between ranks apart and condition than for the MFQ.

As in previous studies, these models suggest weakly increasing τ for choices between lower ranked foundations. There are no consistent differences across condition.

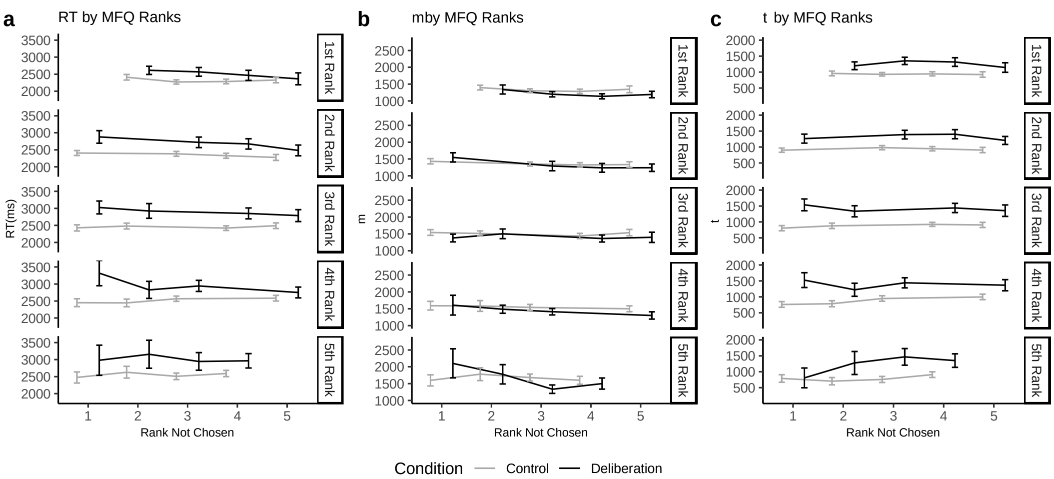

Figure 13.10. Condition and ranks chosen on MFQ, split by ranks not chosen, predicting RT (a), μ (b) and τ (c) for Study 4. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

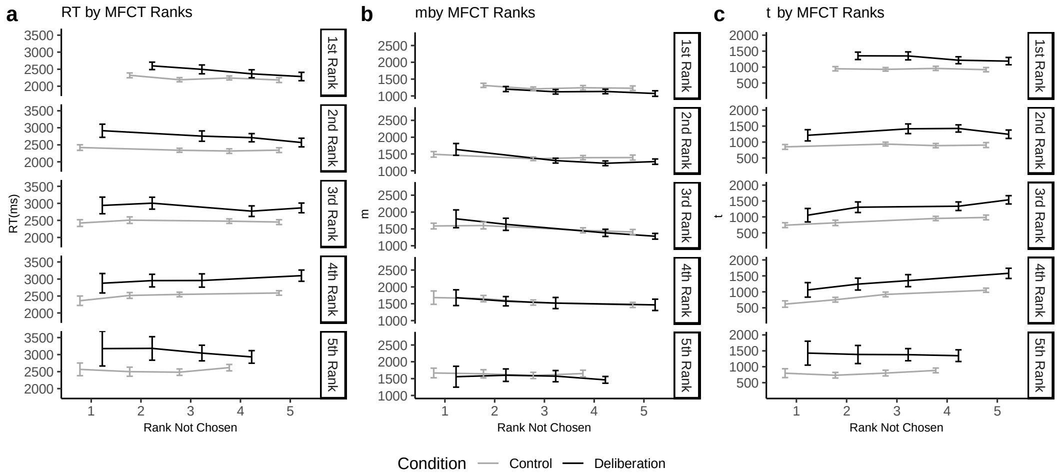

Figure 13.11. Condition and ranks chosen on MFCT, split by ranks not chosen, predicting RT (a), μ (b) and τ (c) for Study 4. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

Table 13.13. Predicting RT, μ and τ for 1st Rank choices on the MFQ and MFCT for Study 3

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	-.10 (.07)	.06 (.06)	-.18** (.06)	-.11 (.07)	.09 (.06)	-.20*** (.06)
Condition	.26* (.12)	-.26* (.11)	.53*** (.10)	.29* (.12)	-.27* (.11)	.57*** (.10)
Ranks Apart (RA)						
2 RNC v. 3, 4, 5	.13** (.04)	.17** (.06)	-.03 (.07)	.15*** (.04)	.18** (.06)	.07 (.06)
3 RNC v. 4, 5	-.004 (.05)	.04 (.07)	.02 (.07)	-.01 (.04)	-.07 (.07)	.08 (.07)
4 RNC v. 5	.03 (.06)	.003 (.09)	-.004 (.10)	.09† (.05)	.05 (.08)	-.01 (.08)
Condition : RA						
Condition : 2 RNC v. 3, 4, 5	.03 (.08)	.13 (.11)	-.09 (.12)	.07 (.07)	.02 (.11)	.04 (.10)
Condition : 3 RNC v. 4, 5	.14† (.08)	.06 (.12)	.07 (.13)	.22** (.07)	.12 (.11)	.11 (.11)
Condition : 4 RNC v. 5	.13 (.11)	.0001 (.15)	.17 (.16)	-.01 (.09)	.13 (.14)	.001 (.13)
Random effects						
By Subject - σ						
Intercept	.86	.72	.65	.88	.71	.68
Residual	.47	.67	.71	.45	.68	.67

Marginal R^2 / Conditional R^2	.02 / .78	.03 / .55	.07 / .49	.03 / .80	.03 / .53	.08 / .55
LogLik	-893	-1,088	-1,115	-946	-1,215	-1,194
AIC	1,807	2,196	2,250	1,912	2,450	2,409
BIC	1,854	2,244	2,298	1,961	2,499	2,457

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 874 (MFQ) and 970 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. For condition: control is the reference level. Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

Table 13.14. Predicting RT, μ and τ for 2nd Rank choices on the MFQ and MFCT for Study 4

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	-.13† (.07)	.04 (.06)	-.16** (.06)	-.14* (.07)	.04 (.06)	-.20*** (.06)
Condition	.35** (.12)	-.14 (.11)	.48*** (.10)	.42*** (.12)	-.12 (.10)	.57*** (.10)
Ranks Apart (RA)						
1 RNC v. 3, 4, 5	.07 (.05)	.16* (.07)	-.24*** (.07)	.05 (.05)	.18** (.07)	.07 (.06)
3 RNC v. 4, 5	.07 (.05)	.03 (.07)	.03 (.07)	.01 (.05)	-.06 (.07)	.08 (.07)
4 RNC v. 5	.08 (.07)	.01 (.10)	.04 (.10)	-.002 (.06)	.03 (.08)	-.01 (.08)
Condition : RA						
Condition : 1 RNC v. 3, 4, 5	.10 (.08)	.33** (.12)	.02 (.12)	.13 (.08)	.37** (.12)	.04 (.10)
Condition : 3 RNC v. 4, 5	.06 (.09)	.04 (.13)	.08 (.13)	.10 (.08)	.19 (.12)	.11 (.11)
Condition : 4 RNC v. 5	.15 (.11)	-.06 (.16)	.15 (.16)	.12 (.10)	-.12 (.14)	.001 (.13)
Random effects						
By Subject - σ						
Intercept	.85	.70	.65	.84	.69	.62
Residual	.48	.70	.71	.50	.71	.73
Marginal R^2 / Conditional R^2	.04 / .77	.02 / .51	.07 / .49	.04 / .75	.03 / .50	.08 / .46
LogLik	-896	-1,101	-1,096	-997	-1,212	-1,194
AIC	1,812	2,221	2,213	2,014	2,444	2,409

BIC	1,859	2,269	2,260	2,062	2,492	2,457

Note. † p < .10, * p < .05, ** p < .01, *** p < .001. Number of observations = 862 (MFQ) and 953 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. For condition: control is the reference level. Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

Table 13.15. Predicting RT, μ and τ for 3rd Rank choices on the MFQ and MFCT for Study 4

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	-.11 (.07)	.08 (.06)	-.18** (.05)	-.11 (.07)	.06 (.06)	-.17** (.05)
Condition	.40*** (.12)	-.21† (.11)	.60*** (.09)	.38** (.12)	-.10 (.11)	.49*** (.09)
Ranks Apart (RA)						
1 RNC v. 2, 4, 5	-.05 (.05)	.11 (.07)	-.20* (.08)	-.02 (.05)	.23** (.07)	-.33*** (.08)
2 RNC v. 4, 5	-.04 (.05)	.09 (.07)	-.26** (.09)	-.0001 (.05)	.23** (.07)	-.37*** (.08)
4 RNC v. 5	-.04 (.07)	-.07 (.09)	-.06 (.11)	.03 (.06)	.09 (.08)	-.09 (.09)
Condition : RA						
Condition : 1 RNC v. 2, 4, 5	.20* (.09)	-.05 (.12)	.16 (.14)	-.01 (.09)	.21 (.13)	-.03 (.15)
Condition : 2 RNC v. 4, 5	.14 (.09)	.16 (.12)	.09 (.15)	.08 (.08)	.09 (.12)	.02 (.14)
Condition : 4 RNC v. 5	.07 (.11)	.11 (.15)	.05 (.18)	-.15 (.10)	.08 (.14)	-.13 (.16)
Random effects						
By Subject - σ						
Intercept	.85	.74	.54	.84	.68	.50
Residual	.48	.67	.79	.49	.71	.80
Marg. R^2 / Cond. R^2	.04 / .77	.02 / .56	.10 / .39	.03 / .75	.03 / .49	.10 / .35
LogLik	-860	-1,021	-1,071	-939	-1,144	-1,177
AIC	1,739	2,062	2,162	1,898	2,307	2,374
BIC	1,786	2,109	2,209	1,946	2,355	2,422

Note. † p < .10, * p < .05, ** p < .01, *** p < .001. Number of observations = 811 (MFQ) and 891 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. For condition: control is the reference level. Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

Table 13.16. Predicting RT, μ and τ for 4th Rank choices on the MFQ and MFCT for Study 4

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	-.10 (.07)	.06 (.06)	$-.17^{**}$ (.06)	-.11 (.07)	.05 (.06)	$-.18^{***}$ (.05)
Condition	$.35^{**}$ (.12)	$-.18^{\dagger}$ (.11)	$.54^{***}$ (.09)	$.37^{**}$ (.12)	-.08 (.11)	$.45^{***}$ (.09)
Ranks Apart (RA)						
1 RNC v. 2, 3, 5	-.08 (.06)	.10 (.09)	$-.29^{**}$ (.09)	$-.10^{\dagger}$ (.06)	$.17^{\dagger}$ (.09)	$-.47^{***}$ (.10)
2 RNC v. 3, 5	-.08 (.07)	.09 (.09)	$-.33^{***}$ (.10)	-.05 (.05)	$.19^{*}$ (.08)	$-.38^{***}$ (.08)
3 RNC v. 5	-.01 (.08)	.09 (.10)	$-.20^{\dagger}$ (.11)	-.01 (.06)	.10 (.09)	$-.22^{*}$ (.10)
Condition : RA						
Condition : 1 RNC v. 2, 3, 5	$.26^{*}$ (.11)	-.06 (.15)	$.38^{*}$ (.16)	-.06 (.10)	.08 (.15)	-.01 (.17)
Condition : 2 RNC v. 3, 5	.04 (.11)	.14 (.15)	-.02 (.16)	-.02 (.08)	-.04 (.13)	.13 (.14)
Condition : 3 RNC v. 5	.12 (.13)	.08 (.17)	.15 (.19)	$-.18^{\dagger}$ (.10)	-.06 (.15)	-.07 (.16)
Random effects						
By Subject - σ						
Intercept	.80	.64	.47	.85	.66	.48
Residual	.55	.75	.83	.48	.73	.81
Marg. R^2 / Cond. R^2	.03 / .69	.01 / .43	.10 / .32	.04 / .77	.01 / .45	.11 / .34
LogLik	-808	-935	-949	-867	-1,079	-1,097
AIC	1,635	1,891	1,918	1,755	2,178	2,214
BIC	1,681	1,937	1,964	1,802	2,225	2,261

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 709 (MFQ) and 827 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. For condition: control is the reference level. Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

Table 13.17. Predicting RT, μ and τ for 5th Rank choices on the MFQ and MFCT for Study 4

	Models	
	MFQ	MFCT

	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	-.08 (.09)	.08 (.08)	-.16* (.07)	-.11 (.07)	.12† (.07)	-.24*** (.06)
Condition	.27† (.16)	-.10 (.14)	.37** (.12)	.39** (.12)	-.21† (.12)	.58*** (.10)
Ranks Apart (RA)						
1 RNC v. 2, 3, 4	-.07 (.08)	-.10 (.10)	-.17 (.12)	.05 (.10)	.17 (.12)	-.22† (.13)
2 RNC v. 3, 4	.04 (.08)	.14 (.11)	-.21† (.12)	-.04 (.08)	.02 (.09)	-.14 (.10)
3 RNC v. 4	-.09 (.08)	.15 (.11)	-.36** (.12)	-.10 (.08)	-.05 (.09)	-.22* (.10)
Condition : RA						
Condition : 1 RNC v. 2, 3, 4	-.08 (.14)	.60** (.19)	-.46* (.21)	-.01 (.16)	-.26 (.19)	.14 (.21)
Condition : 2 RNC v. 3, 4	-.03 (.14)	.23 (.19)	-.10 (.21)	.10 (.14)	.12 (.16)	-.07 (.18)
Condition : 3 RNC v. 4	-.02 (.13)	-.46* (.18)	.30 (.20)	.19 (.13)	.19 (.16)	.27 (.18)
Random effects						
By Subject - σ						
Intercept	.83	.67	.51	.75	.66	.47
Residual	.51	.71	.80	.62	.75	.84
Marg. R^2 / Cond. R^2	.02 / .73	.04 / .49	.09 / .35	.04 / .61	.01 / .45	.09 / .30
LogLik	-508	-595	-616	-762	-826	-843
AIC	1,037	1,211	1,253	1,545	1,672	1,706
BIC	1,078	1,252	1,294	1,589	1,717	1,751

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 465 (MFQ) and 625 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. For condition: control is the reference level. Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

14 Appendix 4: Chapter 8

Structure of MFCT

Exploratory analysis

We then replicated analyses applied in previous studies to assess effects of the structure of the MFCT, specifically looking at whether the valence score and length of item pairings differ across foundation, and if there are any differences in response or RT patterns across blocks on the MFCT

Valence score and length of items

We fit a logistic model predicting whether or not an item was chosen based on valence score and length (Table 14.1). As in previous studies, items with higher valence scores and longer in length are more likely to be chosen.

Table 14.1. Choice by valence score and length for Study 5

	Model	
	β	*OR*
Fixed effects		
Intercept	.01 (.13)	1.01
Valence Score	1.19*** (.01)	3.28
Length	.24*** (.01)	1.27
Valence Score : Length	.29*** (.01)	1.34
Random effects - σ		
Subject	< .001	
Item Pair	.99	
Valence	.05	
Action	.15	
Marginal R^2 / Conditional R^2	.22 / .38	
LogLik	-144,839	
AIC	289,695	
BIC	289,777	

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 223,418. OR – Odds ratios. Fixed and random effects for logistic model predicting choice. Predictors have been standardised. For fixed effects, *SE* is provided in parentheses. Pseudo R^2 calculated using the delta method (Nakagawa et al., 2017).

As in previous studies, valence scores were higher for individualising foundations than for binding foundations, and this is reflected in separate models predicting valence score for choices (Table 14.2). For both chosen, β = -1.82, $p < .001$, and not chosen items, β = -1.76, $p < .001$, binding foundations had lower valence scores than individualising foundations, and were also shorter in length for both chosen, β = -.12, $p < .001$, and not chosen items, β = -.26, $p < .001$.

Table 14.2. Valence score and length of items by foundation for Study 5

	Models			
	Valence Score		Length	
	Chosen	Not Chosen	Chosen	Not Chosen
Fixed effects				
Intercept	-.15*** (.002)	.14*** (.002)	-.01*** (.003)	.03*** (.003)
Foundation				
Binding v. Individualising	-1.82*** (.005)	-1.76*** (.01)	-.12*** (.01)	-.26*** (.01)
Fairness v. Care	.09*** (.003)	.03*** (.004)	-.005 (.004)	-.11*** (.01)
Loyalty v. Authority	.30*** (.004)	.36*** (.004)	.01* (.01)	-.05*** (.01)
Purity v. Authority	-.12*** (.004)	-.04*** (.004)	-.04*** (.01)	-.20*** (.005)
Random effects				
By Subject - σ				
Intercept	.02	< .001	< .001	< .001
Item Pair	.57	.62	1.00	.98
Valence	.21	.21	.05	.02
Action	.17	.21	.02	.09
Residual	.14	.11	.04	.05
Marginal R^2/ Conditional R^2	.58 / .98	.51 / .99	.003 / > .99	.04 / > .99
LogLik	-109,912	-118,341	-158,342	-156,528
AIC	219,845	236,702	316,704	313,077
BIC	219,941	236,798	316,801	313,173

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 111,709. Fixed and random effects for separate models predicting valence score and length of chosen and not chosen items in a given trial. Outcome variables have been standardised. Individualising, care and authority are reference levels. For fixed effects, *SE* is provided in parentheses.

As in previous studies, we fit models exploring whether RT might be predicted by valence score and item length (Table 14.3). The difference in valence score did have an effect on RT, β = -.09, p < .001, with quicker choices as the difference in valence score between items in a trial increased. There was also an effect for the difference in the length of items on RT, β = .05, p < .001, with slower choices between items with a larger difference in length.

Table 14.3. RT by difference in valence score and length for Study 5

	Models	
	log RT	
Fixed effects		
Intercept	-.001 (.02)	-.001 (.02)
Difference in Valence Score	-.09*** (.002)	
Difference in Length		.05*** (.002)
Random effects		
By Subject - σ		
Intercept	.63	.63
Item Pair	.44	.44
Valence	.44	.44
Action	.44	.44
Residual	.17	.17
Marginal R^2 / Conditional R^2	.01 / .97	.002 / .97
LogLik	-131,706	-132,213
AIC	263,425	264,440
BIC	263,493	264,508

Note. † p < .10, * p < .05, ** p < .01, *** p < .001. Number of observations = 111,709. Fixed and random effects for separate models predicting standardised log RT from standardised absolute differences in valence score and length between items in a given trial. For fixed effects, *SE* is provided in parentheses.

Effect of blocks

Table 14.4 shows separate models predicting scores and RT on the MFCT from block valence, block action, and foundation.

Neither the valence, nor the action formulation of items, nor the interaction between valence and action had an effect on MFCT scores. However, the interaction between valence and action did affect RT, β = -.26, p = < .001.with passive items being faster in the virtue block.

There was a significant effect of foundation on MFCT scores, with binding foundations being chosen less than individualising foundations, β = -.48, p < .001. This is reflected in RTs, with binding foundations chosen slower than individualising foundations, β = .20, p < .001. This pattern is consistent with previous studies, even though participants were spread across political orientation, M = 3.29, SD = 1.36, reflected in the smaller effect on MFCT scores than found in previous studies, -.92 < βs < -.75, ps < .001.

Significant interactions between valence, action, and foundation can be seen in Table 14.4, Figure 14.1 and Figure 14.2.

Table 14.4. MFCT score and RT by blocks and foundation for Study 5

	Models	
	MFCT Score	log RT
Fixed effects		
Intercept	-.001 (.01)	.26*** (.02)
Valence (Virtue v. Vice)	-.002 (.02)	-.10*** (.01)
Action (Passive v. Active)	-.001 (.02)	-.26*** (.01)
Foundation		
Binding v. Individualising	-.48*** (.03)	.20*** (.01)
Fairness v. Care	-.82*** (.02)	.18*** (.01)
Loyalty v. Authority	-.12*** (.02)	.01† (.01)
Purity v. Authority	-.01 (.02)	.05*** (.01)
Valence : Action	.002 (.03)	-.19*** (.01)
Valence : Foundation		
Valence : Binding v. Individualising	-.89*** (.04)	-.02 (.02)
Valence : Fairness v. Care	.76*** (.03)	-.14*** (.01)
Valence : Loyalty v. Authority	.45*** (.03)	-.03** (.01)
Valence : Purity v. Authority	.28*** (.03)	-.07*** (.01)
Action : Foundation		
Action : Binding v. Individualising	-.74*** (.04)	.06*** (.02)
Action : Fairness v. Care	.03 (.03)	.002 (.01)

Action : Loyalty v. Authority	.42*** (.03)	.02† (.01)
Action : Purity v. Authority	-.12*** (.03)	-.08*** (.01)
Valence : Action : Foundation		
Valence : Action : Binding v. Individualising	1.03*** (.06)	-.17*** (.02)
Valence : Action : Fairness v. Care	-.33*** (.04)	.02 (.01)
Valence : Action : Loyalty v. Authority	-.99*** (.05)	.02 (.02)
Valence : Action : Purity v. Authority	-.60*** (.05)	.08*** (.02)
Random effects		
By Subject - σ		
Intercept	< .001	.63
Residual	.76	.74
Marginal R^2 / Conditional R^2	.42 / .42	.06 / .45
LogLik	-16,107	-126,870
AIC	32,257	253,785
BIC	32,423	253,997

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 14,000 (MFCT Score) and 111,709 (log RT). Fixed and random effects for separate models predicting MFCT score and log RT. Outcome variables have been standardised. For RT model, foundation represents the foundation of the item chosen in a given trial. Planned contrasts for foundation compare individualising to binding foundations (with the former as the reference level), and then compare Care to Fairness (former as reference level), and Authority to Loyalty and Purity (Authority as reference level). For valence and action, vice and active are reference levels. For fixed effects, *SE* is provided in parentheses.

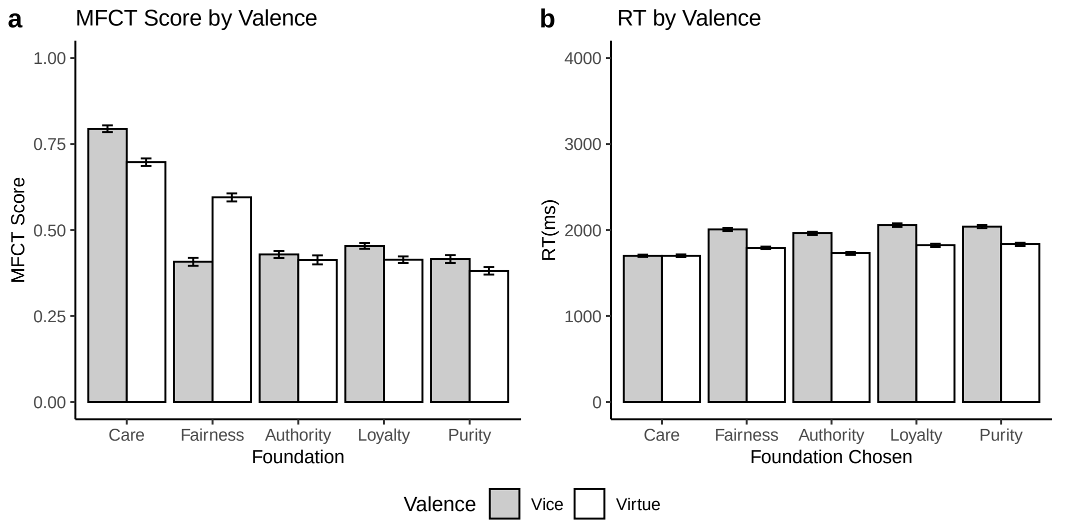

Figure 14.1. MFCT score (a) and RT (b) by valence block and foundation in Study 5. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

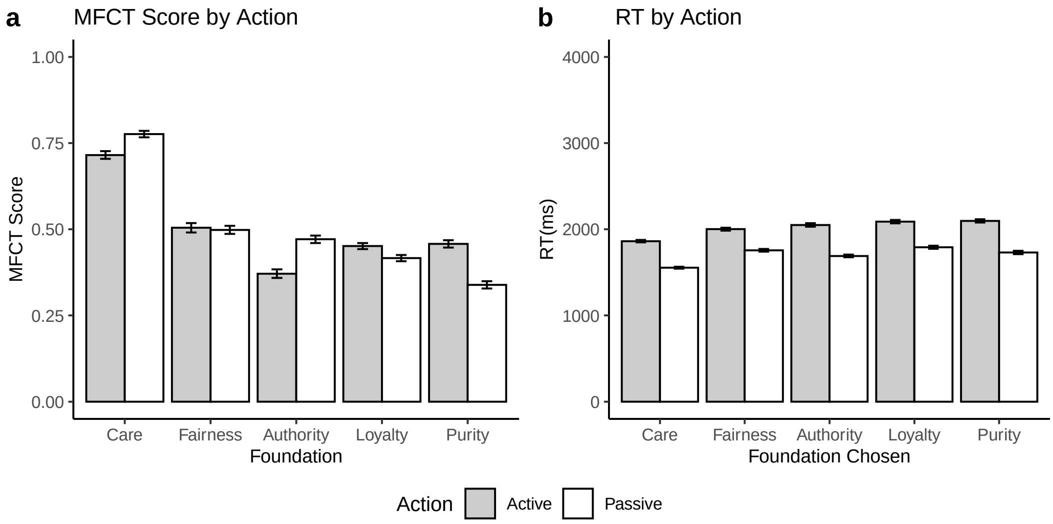

Figure 14.2. MFCT score (a) and RT (b) by action block and foundation in for Study 5. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

Within-subject mean RTs and Ex-Gaussian parameters were fit for each block (see Table 14.5 and Figure 14.3). The interaction between valence and action predicted mean RT, β = -.38, p < .001, μ, β = -.19, p < .001, and τ, β = -.11, p < .05, indicating faster processing speed and lower conflict for passive virtue items.

Table 14.5. RT, μ and τ by blocks for Study 5

	Models		
	log RT	log μ	log τ
Fixed effects			
Intercept	.31*** (.04)	.28*** (.04)	.17*** (.04)
Valence (Virtue v. Vice)	-.12*** (.02)	-.07* (.03)	-.12** (.04)
Action (Passive v. Active)	-.38*** (.02)	-.39*** (.03)	-.17*** (.04)
Valence : Action	-.24*** (.03)	-.19*** (.04)	-.11* (.05)
Random effects			
By Subject - σ			
Intercept	.88	.76	.71
Residual	.38	.59	.69
Marginal R^2 / Conditional R^2	.08 / .85	.07 / .65	.02 / .53
LogLik	-2,366	-3,214	-3,501
AIC	4,743	6,440	7,014
BIC	4,779	6,475	7,049

Note. † p < .10, * p < .05, ** p < .01, *** p < .001. Number of observations = 2,800. Fixed and random effects for separate models predicting log RT, μ and τ. Outcome variables have been standardised. For valence and action, vice and active are reference levels. For fixed effects, *SE* is provided in parentheses.

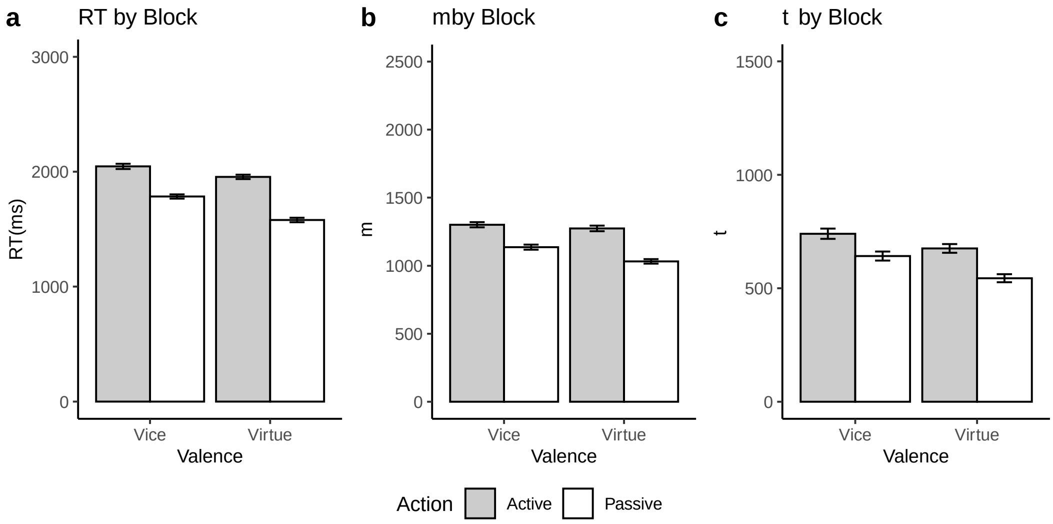

Figure 14.3. Mean RT (a), *μ (b)* and *τ* (c) by blocks. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

As in previous studies, these analyses indicate that the block structure of the task does impact response patterns and RTs on the MFCT differentially across foundations. For RT, it is quicker and easier to make choices between virtue and passive items.

Table 14.6 shows split-half reliability coefficients. Reliability for the full task, and across blocks in the task, is acceptable, but slightly lower for the active blocks, likely reflecting more complex items in these blocks.

Table 14.6. Bootstrapped split-half reliability across blocks for Study 5

	r_{Boot}	Bias	95% CI of *r*	*SE* r_{Boot}
Study 5 (*N* = 700)				
Full Task	.79	.03	[.73 , .80]	.02
Vice	.77	.02	[.71, .79]	.02
Virtue	.75	-.02	[.70, .83]	.03
Active	.65	.09	[.50, .62]	.03
Passive	.79	.004	[.75, .83]	.02

Note. Bootstrapped with 5,000 iterations.

Correlating MFQ and MFCT Scores across blocks

A mean correlation coefficient was calculated for each block to explore whether this correlation maintains across blocks (see Table 14.7). Unlike previous studies, there were differences across blocks, with higher correlations in virtue, *95% CI* [-.24, -.13], and passive blocks, *95% CI* [.07, .17].

Table 14.7. Correlations between MFQ and MFCT scores across blocks for Study 5

	Sample r_τ	$r_{\tau Boot}$	Bias	95% CI of r_τ	$SE\ r_{\tau Boot}$	95% CI of Difference
Study 5 (N = 700)						
Vice	.34	.36	-.016	[.35, .39]	.015	[-.24 , -.13]
Virtue	.49	.48	.004	[.45, .50]	.014	
Active	.36	.35	.015	[.30, .36]	.014	[.07 , .17]
Passive	.46	.46	.002	[.43, .48]	.014	

Note. Bootstrapped with 5,000 iterations. CIs are the Bias Corrected Accelerated (BCa) intervals

Exploratory RT analysis

Weighted difference scores predicting RT

As in previous studies, a difference score was created for each inter-foundation combination to weight the difference between foundation scores by the mean score of the two foundations in a choice (calculated as $mean(Score_1, Score_2) * (1 - abs(Score_1 - Score_2))$. Difference scores based on the MFQ and MFCT correlated at $r = .50$, $p < .001$, *95% CI* [.48, .52].

Separate multilevel models (see Table 14.8) were fit to predict RT for each trial from difference scores based on MFQ and MFCT scores. There were no effects for MFCT difference scores, $\beta = -.004$, p > .10. However there was an effect for MFQ difference scores, $\beta = -.04$, $p < .001$, which contrary to expectation that an increased difference score would predict higher RT, shows a trend in the opposite direction. We found this same effect in Study 2, but not across other studies.

Table 14.8. Predicting RT from difference score based on MFQ and MFCT

	Models	
	log RT	
Fixed effects		
Intercept	-.002 (.02)	-.002 (.02)
Difference Score MFQ	-.04*** (.01)	
Difference Score MFCT		-.004 (.003)
Random effects		
By Subject - σ		
Intercept	.62	.62
Foundation Combination	< .001	< .001
Valence	< .001	< .001
Action	.35	.35
Residual	.70	.70
Marginal R^2 / Conditional R^2	.001 / .51	.00 / .51
LogLik	-129,740	-129,774
AIC	259,493	259,561
BIC	259,560	259,629

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 111,709. Fixed and random effects for separate models predicting log RT. Outcome variables have been standardised. Difference score calculated as $mean(Score_1, Score_2) * (1 - abs(Score_1 - Score_2))$. For fixed effects, *SE* is provided in parentheses.

As in previous studies, a further set of models were fit, collapsing RT and fitting within-subject Ex-Gaussian parameters to RT distributions for each inter-foundation combination (see Table 14.9). Here, difference score based on MFQ scores negatively predicted RT, μ, and τ, βs < -.05, *p*s < .001, with a marginal effect for μ based on MFCT difference scores, $\beta = -.01$, $p < .10$. Generally, these analyses suggest that the weighted difference score does not adequately or reliably capture differences in value.

Table 14.9. Predicting RT, μ and τ from difference score based on MFQ and MFCT

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	-.00 (.04)	-.00 (.03)	-.00 (.03)	-.00 (.04)	-.00 (.03)	-.00 (.03)
Difference Score MFQ	-.06*** (.01)	-.05*** (.01)	-.05*** (.01)			
Difference Score MFCT				-.004 (.005)	-.01† (.01)	-.01 (.01)
Random effects						
By Subject - σ						
Intercept	.93	.80	.64	.93	.80	.64
Foundation Combination	.32	.54	.71	.32	.54	.71
Residual	.18	.25	.30	.18	.25	.30
Marginal R^2 / Conditional R^2	.003 / .97	.003 / .94	.002 / .91	.00 / .97	.00 / .94	.00 / .91
LogLik	-4,251	-7,309	-8,806	-4,285	-7,321	-8,812
AIC	8,513	14,629	17,623	8,579	14,651	17,634
BIC	8,547	14,663	17,657	8,614	14,685	17,668

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 7,000. Fixed and random effects for separate models predicting log RT, μ and τ, estimated for each foundation combination. Outcome variables have been standardised. Difference score calculated as *mean*($Score_1$, $Score_2$) * (1 - *abs*($Score_1$ - $Score_2$)). For fixed effects, *SE* is provided in parentheses.

Ranks apart split by rank chosen predicting RT

As in previous studies, we replicated ranks apart analyses on RT distributions split by the rank of the foundation that was chosen in each trial.

Multilevel models were fit to predict RT, μ and τ for each rank, based on the MFQ and the MFCT, that was chosen from the rank not chosen in a given trial (see Table 14.10 to Table 14.14). Here, we dropped equally ranked choices as these occurred much less frequently than other choices. A set of planned contrasts compare each rank category to the mean of the subsequent rank categories.

Ranks apart split by split by rank chosen on MFQ

Figure 14.4 shows plots for RT, μ and τ for each rank chosen, based on MFQ scores. As in previous studies, there were indications of shifting patterns of RT, μ and τ, across rank choices.

Choosing against the highest other rank – i.e. against 2nd when the 1st rank was chosen, or against the 1st rank when the 5th rank was chosen – tended to incur higher mean RT for 1st and 2nd rank choices, βs > .04, *p*s < .05, shifting to lower mean RT for 3rd and 5th rank choices, βs < -.07, *p*s < .01. In contrast, μ was significantly higher in choices against the highest other rank in all but 5th rank choices, βs > .07, *p*s < .10, while τ was lower, βs < -.08, *p*s < .05. This dissociation between μ and τ carries through all rank choices, with weakly decreasing μ, and increasing τ as choices are made between foundations lower and further apart in value. However, this is only significant as a trend in lower rank choices, with decreasing μ in 3rd and 4th rank choices, βs > .07, *p*s < .10, and increasing τ in 3rd, 4th and 5th rank choices, βs < -.16, *p*s < .001, where the 1st and 2nd rank is not chosen compared to lower ranks.

Taken together, these models suggest a weak pattern with μ decreasing, and τ increasing, for choices between lower ranked foundations, indicating a decreasing time to physically make choices, but increasing decision conflict.

Ranks apart split by split by rank chosen on MFCT

Figure 14.5 shows plots for RT, μ and τ for each rank chosen, based on MFCT scores. There was a consistent trend in 1st rank choices, where RT decreased as the value of the foundation not chosen decreased, βs > .03, *p*s < .05. However, this was not the trend in RT across all choices – choosing against the highest other rank tended to incur lower mean RT for 2nd, 4th and 5th rank choices, βs < -.04, *p*s < .05. There were no other effects in mean RT, βs < |.03|, *p*s > .10.

There were no effects for μ and τ in 1st rank choices, βs < |.07|, *p*s > .10, and only an effect for μ in 2nd rank choices, with higher μ in choices against 1st rank compared to lower ranks, β = -.11, *p* > .001.

As with ranks based on the MFQ, a dissociation between μ and τ came through as a trend in lower rank choices, with decreasing μ in 3rd and 5th rank choices, βs > .06, *p*s < .10, and increasing τ in 3rd, 4th, and 5th rank choices, βs < -.11, *p*s < .05, where the

1st, 2nd rank, and 3rd (for 4th and 5th rank choices) is not chosen compared to lower ranks.

Similar to those based on MFQ scores, these models suggest weak patterns of decreasing μ, and increasing τ, for choices between lower ranked foundations, indicating decreasing time to physically make choices, but increasing decision conflict.

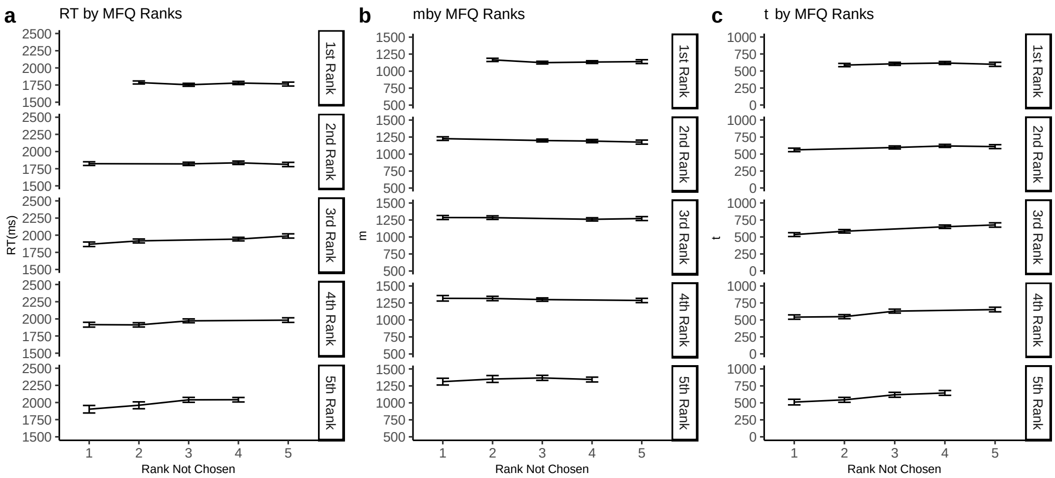

Figure 14.4. Ranks chosen on MFQ, split by ranks not chosen, predicting RT (a), μ (b) and τ (c) for Study 5. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

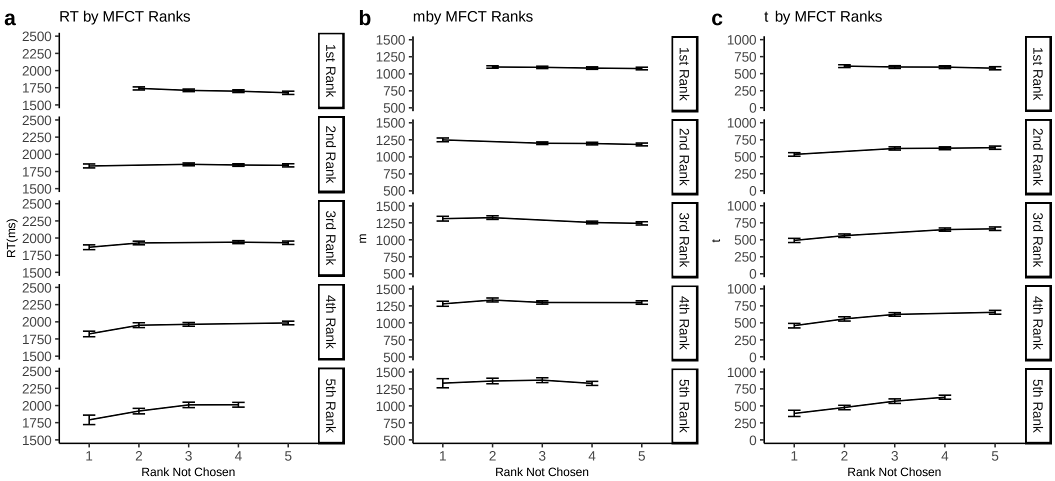

Figure 14.5. Ranks chosen on MFCT, split by ranks not chosen, predicting RT (a), μ (b) and τ (c) for Study 5. Error bars denote 95% CIs, corrected for within-subject designs based on Morey (2008).

Table 14.10. Predicting RT, μ and τ for 1st Rank choices on the MFQ and MFCT for Study 5

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	-.02 (.04)	-.02 (.03)	.01 (.03)	-.01 (.04)	-.01 (.03)	-.003 (.03)
Ranks Apart						
2 RNC v. 3, 4, 5	.06*** (.02)	.09*** (.03)	-.08* (.04)	.07*** (.02)	.03 (.03)	.05 (.03)
3 RNC v. 4, 5	.001 (.02)	.003 (.03)	-.05 (.04)	.03* (.02)	.03 (.03)	.02 (.04)
4 RNC v. 5	.06* (.03)	.04 (.04)	.02 (.05)	.05* (.02)	.03 (.03)	.07 (.04)
Random effects						
By Subject - σ						
Intercept	.93	.82	.59	.93	.81	.66
Residual	.38	.59	.80	.37	.59	.75
Marginal R^2 / Conditional R^2	.001 / .86	.002 / .66	.002 / .35	.001 / .87	.00 / .66	.001 / .44
LogLik	-2,125	-2,814	-3,232	-2,228	-3,074	-3,472
AIC	4,263	5,641	6,476	4,469	6,161	6,955
BIC	4,297	5,675	6,510	4,504	6,196	6,991

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 2,390 (MFQ) and 2,648 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

Table 14.11. Predicting RT, μ and τ for 2nd Rank choices on the MFQ and MFCT for Study 5

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	-.01 (.04)	-.01 (.03)	.001 (.03)	.001 (.04)	.01 (.03)	-.003 (.03)
Ranks Apart						
1 RNC v. 3, 4, 5	.04* (.02)	.11*** (.03)	-.17*** (.04)	-.04* (.02)	.11*** (.03)	.05 (.03)
3 RNC v. 4, 5	.02 (.02)	.06* (.03)	-.05 (.04)	.03 (.02)	.03 (.03)	.02 (.04)
4 RNC v. 5	.05† (.03)	.02 (.04)	.07 (.05)	.02 (.02)	.03 (.04)	.07 (.04)
Random effects						
By Subject - σ						
Intercept	.92	.81	.57	.91	.79	.57

Residual	.42	.60	.82	.40	.61	.81
Marginal R^2 / Conditional R^2	.001 / .83	.003 / .64	.01 / .33	.001 / .84	.002 / .63	.03 / .35
LogLik	-2,253	-2,809	-3,175	-2,346	-3,043	-3,472
AIC	4,518	5,630	6,361	4,704	6,098	6,955
BIC	4,553	5,664	6,396	4,739	6,133	6,991

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 2,335 (MFQ) and 2,564 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

Table 14.12. Predicting RT, μ and τ for 3rd Rank choices on the MFQ and MFCT for Study 5

	Models					
	MFQ			MFCT		
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	.02 (.04)	.01 (.03)	.01 (.03)	.02 (.04)	.02 (.03)	-.004 (.03)
Ranks Apart						
1 RNC v. 2, 4, 5	-.07** (.02)	.09** (.03)	-.33*** (.04)	-.03 (.02)	.12*** (.03)	-.36*** (.04)
2 RNC v. 4, 5	-.01 (.02)	.10** (.03)	-.16*** (.04)	-.01 (.02)	.16*** (.03)	-.30*** (.04)
4 RNC v. 5	-.03 (.03)	.001 (.04)	-.04 (.06)	.02 (.02)	.05 (.03)	-.05 (.05)
Random effects						
By Subject - σ						
Intercept	.89	.80	.53	.90	.80	.52
Residual	.45	.60	.84	.43	.59	.83
Marginal R^2 / Conditional R^2	.001 / .80	.003 / .64	.02 / .30	.00 / .81	.01 / .65	.04 / .31
LogLik	-2,230	-2,619	-2,964	-2,348	-2,847	-3,281
AIC	4,472	5,249	5,940	4,707	5,706	6,574
BIC	4,506	5,283	5,974	4,742	5,741	6,609

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 2,168 (MFQ) and 2,418 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

Table 14.13. Predicting RT, μ and τ for 4th Rank choices on the MFQ and MFCT for Study 5

	Models					
		MFQ			MFCT	
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	.04 (.04)	.02 (.03)	.01 (.03)	.03 (.03)	.03 (.03)	-.02 (.03)
Ranks Apart						
1 RNC v. 2, 3, 5	-.001 (.03)	$.07^{\dagger}$ (.04)	$-.23^{***}$ (.05)	$-.11^{***}$ (.03)	.01 (.03)	$-.39^{***}$ (.05)
2 RNC v. 3, 5	-.01 (.03)	$.08^{*}$ (.04)	$-.17^{***}$ (.05)	-.01 (.02)	$.09^{**}$ (.03)	$-.25^{***}$ (.04)
3 RNC v. 5	.03 (.03)	.07 (.04)	-.09 (.06)	-.02 (.03)	.02 (.03)	$-.11^{*}$ (.05)
Random effects						
By Subject - σ						
Intercept	.89	.77	.48	.87	.79	.44
Residual	.44	.63	.87	.46	.60	.88
Marginal R^2 / Conditional R^2	.00 / .80	.002 / .61	.01 / .24	.002 / .78	.002 / .64	.03 / .23
LogLik	-2,015	-2,435	-2,748	-2,319	-2,686	-3,105
AIC	4,042	4,883	5,508	4,650	5,383	6,222
BIC	4,076	4,916	5,541	4,684	5,417	6,256

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 1,984 (MFQ) and 2,253 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.

Table 14.14. Predicting RT, $\boldsymbol{\mu}$ and $\boldsymbol{\tau}$ for 5th Rank choices on the MFQ and MFCT for Study 5

	Models					
		MFQ			MFCT	
	log RT	log μ	log τ	log RT	log μ	log τ
Fixed effects						
Intercept	.03 (.05)	.04 (.04)	-.02 (.04)	.04 (.04)	$.06^{\dagger}$ (.04)	-.04 (.03)
Ranks Apart						
1 RNC v. 2, 3, 4	$-.12^{***}$ (.03)	.003 (.04)	$-.25^{***}$ (.06)	$-.11^{**}$ (.04)	$.10^{*}$ (.05)	$-.34^{***}$ (.06)
2 RNC v. 3, 4	$-.07^{*}$ (.03)	.02 (.04)	$-.22^{***}$ (.06)	-.04 (.03)	$.06^{\dagger}$ (.04)	$-.26^{***}$ (.05)
3 RNC v. 4	.005 (.03)	.06 (.04)	-.07 (.06)	.001 (.03)	$.07^{\dagger}$ (.04)	$-.13^{*}$ (.05)

Random effects						
By Subject - σ						
Intercept	.88	.79	.49	.86	.77	.45
Residual	.44	.60	.86	.47	.62	.88
Marginal R^2 / Conditional R^2	.003 / .80	.001 / .63	.02 / .26	.002 / .77	.003 / .61	.03 / .23
LogLik	-1,245	-1,500	-1,734	-1,820	-2,107	-2,380
AIC	2,502	3,012	3,479	3,652	4,225	4,772
BIC	2,532	3,043	3,510	3,685	4,258	4,804

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Number of observations = 1,259 (MFQ) and 1,725 (MFCT). RNC – Rank not Chosen. Fixed and random effects for separate models predicting log RT, μ and τ for ranks apart based on the MFQ and the MFCT. Outcome variables have been standardised. Helmert coding compares each rank category to the mean of the subsequent categories. For fixed effects, *SE* is provided in parentheses.